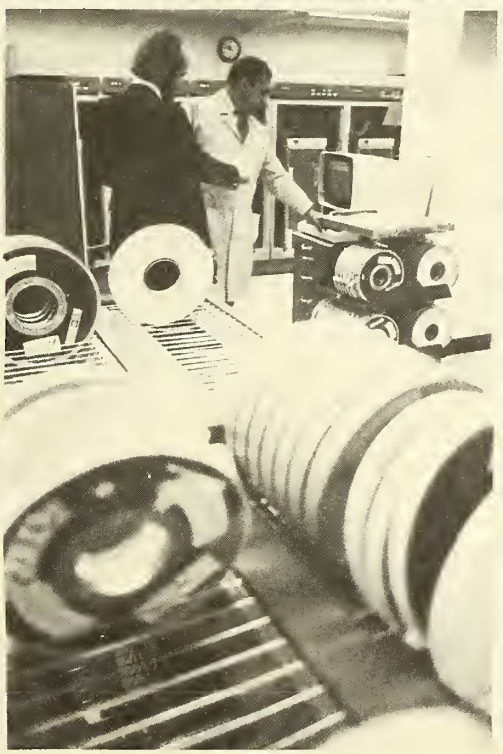
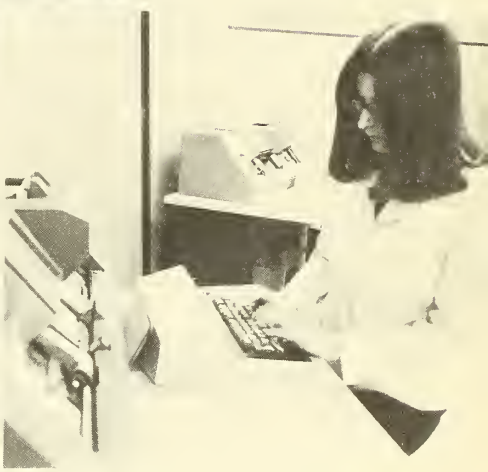
Technical Release No. 61

WSP2 Computer Program





Engineering Division
Soil Conservation Service
U.S. Department of Agriculture
May 1976

PREFACE

This technical release was prepared by hydraulic engineers from the SCS Central Technical Unit, Hyattsville, Md. It was approved by personnel from the Engineering Division, Washington, D.C.; from the regional technical service centers; and from state SCS offices.

This technical release will assist engineers in preparing data for the WSP2 computer program. It will also help engineers understand the programmed procedures and consequently interpret answers properly.

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WSP2 COMPUTER PROGRAM

A water surface profile computer program for determining flood elevations and flood areas for certain flow rates

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Terms and Notations

A—Cross sectional area (ft^2)

g—Acceleration of gravity (32.2 ft/sec^2)

h—Flow depth (ft)

KD—Conveyance equal to $\frac{1.486}{n} A r^{2/3}$

M—Ratio of conveyances in the BPR bridge loss analysis

n—Manning's coefficient of roughness

P—Wetted perimeter—the length of wetted surface measured along a cross section

Q—Discharge (ft^3/sec)

r—Hydraulic radius or the ratio of area to wetted perimeter

T—Section top width at the free water surface (ft)

csm—Cubic feet per second per square mile

Energy level.—Elevation of energy grade line which is water surface elevation plus velocity head.

Segment.—A part of the valley section that has uniform roughness and no rapid change in wetted perimeter with a small change in depth.

Damage segment.—The part of the cross section where economic losses occur.

Nondamage segment.—The part of the cross section that is not a part of the channel system and where economic losses are not considered.

Introduction

The WSP2 (Water Surface Profile 2) computer program can aid in the determination of flow characteristics for a given set of stream and flood-plain conditions. More specifically, it can compute water surface profiles in open channels. The program also can estimate head losses at restrictive sections, including roadways with either a bridge opening or culverts.

To use this program effectively, thorough understanding of the following procedures is necessary:

1. Procedures described in SCS National Engineering Handbook, Section 4, Chapter 14 (hereafter referred to as NEH-4).

2. Bridge loss analysis described in "Hydraulics of Bridge Waterways," Hydraulic Design Series No. 1, 2nd ed., Bureau of Public Roads, U.S. Department of Transportation, Washington, D.C., 1970 (hereafter referred to as BPR Manual).

3. Standard step method for running backwater profiles. One of several books in which this method is described is Ven Te Chow's "Open Channel Hydraulics," McGraw Hill Co., New York, 1959.

WSP2 is written in Fortran IV computer language and was developed on an IBM 360/65 computer. The three subprograms (HROFDA, DATE, and REREAD) were written in assembly language. Various field locations have adapted WSP2 to CDC and Univac systems.

The program requires about 220 kilobytes of core storage and three temporary data files. Specific information about the data files is on comment cards at the beginning of the program listing. A WSP2 systems guide is available from the SCS Central Technical Unit to aid in implementing, understanding, debugging, and modifying the program.

Because the computations require a large amount of physical data on valley shape, roughness, flow restrictions, etc., an attempt was made to make data entry as easy and flexible as possible. Punched output cards provide direct input to SCS flood routing and economic analysis computer programs.

Capabilities

WSP2 can rate a valley at specified points. This rating provides information on elevation, discharge, flow area, and flooded area. The program computes up to 15 water surface profiles for a combined total of 50 reach and road sections. The discharge rate for each profile can be constant, variable, or user-selected. A job can be extended beyond 50 sections by the LINK feature and beyond 15 profiles by the CHANGE feature. The use of these features is described in detail in another section. More than one job can be processed in one run by putting the ENDJOB card after each job and the ENDRUN card after all of the jobs. Results of computations from up to 20 cross sections can be saved for later computations by using a TRIB card.

The shape of each valley cross section can be defined by up to 48 horizontal and vertical points. The vertical coordinate can be given in either elevation or rod reading. The points can be entered in order or randomly. If points are entered randomly, WSP2 automatically reorders them according to increasing horizontal distance, except for points that have identical horizontal distance. Such points must be entered in the correct order because WSP2 will not change their order of entry. A cross section

can be divided into a maximum of six segments representing different characteristics. At least one segment must be a channel segment. The remainder can be channel, damage, or nondamage segments. The segments must begin and end on points that appear in the section table.

Manning's roughness coefficient 'n' can be changed at user-specified values of hydraulic radius.

At any one road restriction, WSP2 can compute head losses through one bridge opening or up to five culvert openings with different configuration. Each of the five culvert openings can have an unlimited number of identical culverts. Although one bridge opening along with several culvert openings can be defined for one road restriction, the procedure has not yet been fully developed.

Methodology

Valley Section Analysis

The standard step method, with some modifications, is used to compute profiles between valley sections. All profiles are computed in the upstream direction. Therefore, only subcritical flow can be analyzed. The letter 'C' appears on the output when critical or supercritical flow occurs (see section 92100 of the sample output).

After defining a starting valley section, the program can start computations from given elevations, from given slopes, or if no starting information is given, from critical depths. All profiles at a given beginning point must be started in the same manner. Once the downstream starting information is developed, the following steps are needed at the upstream section to extend the profile upstream.

Step 1.—Determine a set of elevation values at the upstream section corresponding to the following depths:

0.0			
0.2	5.6	18.2	38.0
0.4	6.4	19.6	40.0
0.6	7.2	21.0	42.0
0.8	8.0	22.4	44.0
1.2	9.0	24.0	46.2
1.6	10.0	25.6	48.4
2.0	11.0	27.2	50.6
2.4	12.0	28.8	52.8
3.0	13.2	30.6	55.2
3.6	14.4	32.4	57.6
4.2	15.6	34.2	60.0
4.8	16.8	36.0	62.4

The elevation table stops at the highest of the two end points of the cross section. WSP2 places a vertical side wall on the low side to extend the lowest end point up to the elevation of the highest end point. For sections more than 62 feet deep, each of the depths is doubled before computing the elevations.

Step 2.—Compute area and conveyance (KD) values for each segment for the elevations chosen in step 1. The KD values for flood-plain segments are adjusted to reflect their shorter reach length. This technique is described in chapter 14 of NEH-4. For any elevation, WSP2 interpolates or extrapolates area values on a linear basis and KD values on a log basis. All extrapolations are based on the last two tabulated points.

Step 3.—For each of the elevations chosen in step 1, WSP2 computes and saves critical discharge and velocity head. Critical discharge is computed using the equation

$$Q = \sqrt{\frac{32.2\,A^3}{T}}$$

where A is the valley section area and T is the top width. WSP2 computes the velocity head for an assumed slope of 0.0001 ft/ft and weights the head by the percentage of flow in each segment. The velocity head equals the velocity head for a segment times the percentage of total flow flowing in that segment. The actual velocity head for any assumed upstream elevation

is the tabulated value times the ratio of the actual slope (see step 5 below) to 0.0001. WSP2 interpolates or extrapolates velocity head and critical discharge on a linear basis.

Step 4.—Calculate flow rate (see chapter 14 of NEH-4 for csm adjustments) for the profile being considered. The csm (cubic feet per second per square mile) adjustment is made on a drainage area basis so that each water surface profile closely matches a flood profile. WSP2 interpolates from the table developed in step 3 to determine the elevation at which flow rate is critical.

Step 5.—Figure 1 shows how the energy principle is used in WSP2. Energy is considered balanced when the trial elevation plus velocity head for that elevation (from table developed in step 3) at the upstream section is within 0.1 foot of the energy level at the downstream section plus losses. *Only friction losses are considered in the WSP2 program.* They are found by Manning's equation ($S = (Q/KD)^2$) using Q and KD at the upstream section. The rate of friction loss is S_f, and the total loss is then S_f times the length (L). The critical elevation from step 4 is used first in the trial-and-error energy balance procedure.

Step 6.—If the initial upstream energy level (using critical elevation) is more than the downstream energy level plus friction loss, WSP2 assumes supercritical flow and takes critical elevation as the answer. If the reverse is true, WSP2 assumes subcritical flow, chooses a higher elevation, and recomputes the energy balance. The program iterates until an elevation is found at which the energy equation will balance within 0.1 foot.

For profiles with nearly equal discharges it is possible to get more flow at a lower elevation than at a higher elevation on a rating table. A reversal of as much as 0.2 foot is possible within the 0.1-foot accuracy limit of the energy balance equation. Note that only the total energy elevation at the downstream section is needed to balance energy at the upstream section.

The section rating table contains information at bankfull and zero-damage elevations. Zero-damage elevation is the lowest point in the damage segments. Bankfull elevation is the lowest of all first and last points defining channel segments. Discharge and end-area at these elevations are found by interpolation.

Valley Section Location

Valley sections can serve many needs (geologic, engineering, economic, hydraulic, etc.), and all of them should be considered when selecting the location. For hydraulic purposes, valley sections are surveyed at points along the valley length and need to be representative of several parameters, such as flow area, wetted perimeter, and roughness.

WSP2 considers only energy losses due to friction and uses the rate of friction loss at the upstream section as the rate throughout the reach. Therefore, valley sections should be located as follows. Divide the valley length into reaches that have nearly constant parameters that affect hydraulics and locate the valley section near the upstream end of the reach. In addition to these sections, locate valley sections about 50 to 100 feet *both* upstream *and* downstream from road-type restrictions. Survey sections perpendicular to the direction of flow and not necessarily straight across the valley.

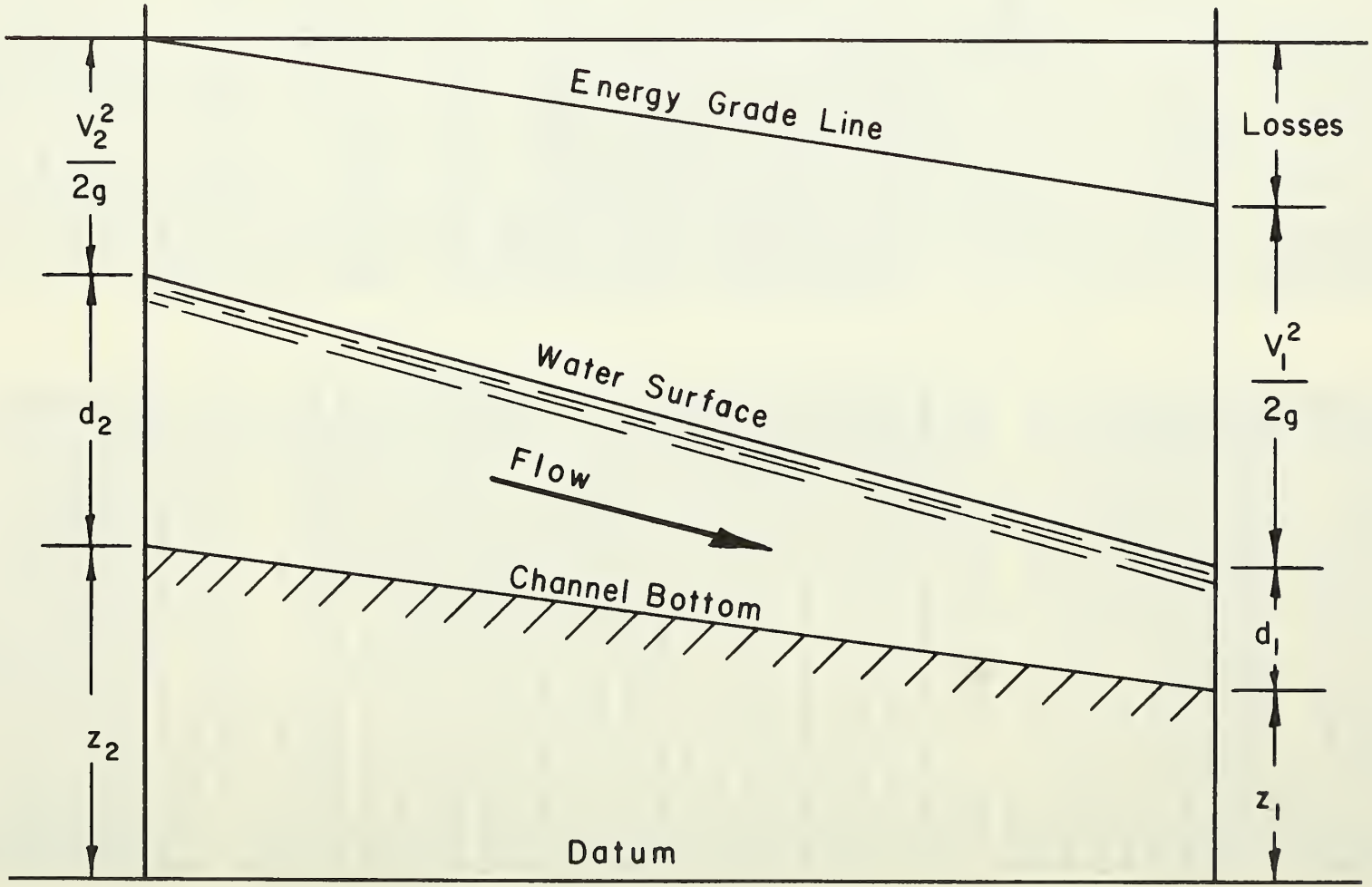
Road Restriction Analysis

WSP2 analyzes a road restriction by determining (1) water surface elevation at the downstream face of the opening through the road embankment (labeled tailwater on the computer printout); (2) head loss due to the restriction (labeled HL in the output; HL plus tailwater is headwater); and (3) water surface elevation at the approach section. Each step is explained below.

Step 1.—The value for tailwater is found by balancing energy between the exit valley section and a new section manufactured by the program at the downstream face of the bridge or culvert. The reach length between the new section and the exit section is the channel length on the road input card. The shape of the new section is the same shape

Figure 1. ENERGY BALANCE EQUATION

$$z_2 + d_2 + \frac{V_2^2}{2g} = z_1 + d_1 + \frac{V_1^2}{2g} + \text{Losses}$$



as the exit section. The exit section is moved vertically so that the low point on the new section is the same as the low point on the road section for a bridge and the same as the outlet invert for a culvert.

Step 2.—The head loss or headwater elevation is found by assuming head losses beginning with zero loss and continuing in small increments. For each assumed loss, WSP2 finds the flow through the bridge opening or culvert(s), calculates the flow over the road, and adds these flows. The final head loss is the assumed loss at which the summed flows agree within 0.1 foot of head. The different procedures used to compute flow for a given head loss at a bridge opening and a culvert are described under the headings "BPR bridge loss analysis," "Culvert loss analysis," and "Contracted opening bridge loss analysis."

Step 3.—After the headwater elevation is determined, energy is balanced from the upstream face of the bridge or culvert to the approach section. In order to do this, a velocity head must be calculated and added to the headwater elevation to get an energy grade line elevation at the upstream face of the bridge or culvert. WSP2 manufactures another section at the upstream face with the same shape as the approach valley section. The approach section is moved vertically so that the low point on the new section is the same as the low point on the road section for a bridge, and the same as the inlet invert for a culvert. Using this new section, WSP2 finds the area, by segment, at the headwater elevation and computes a weighted velocity head. Once this velocity head is found, the water surface profile at the approach section is determined. The length to the approach section is the channel length on the reach card for the approach section.

Flow over embankment analysis

The flow rate over a road is found from a weir equation. Due to the irregular shape (across the valley) of most road surfaces, it is impossible to assume a common geometric shape and develop a specialized weir equation. Therefore, a modification of the rectangular weir equation $Q = CLh^{3/2}$ is used. The modification is the substitution of A (area) for Lh which yields the equation $Q = CAh^{1/2}$.

BPR bridge loss analysis

WSP2 uses a ratio of conveyances (M) to predict losses in the area of a bridge (see BPR Manual). To obtain this ratio, *divide* the conveyance of the approach section for a width equal to the bridge opening width at the bridge tailwater elevation *by* the total approach section conveyance.

The BPR Manual projects bridge abutments in the upstream direction to define the portion of the approach section that will be used for the numerator of the conveyance ratio. This is valid only if the channel in the vicinity of the bridge is straight. Most channels are not straight in the vicinity of bridges. Therefore, a "workable" technique had to be developed for WSP2. The program uses the station for the lowest elevation on the approach section as the center of the bridge opening width. If this extends the width beyond one bank but not the other, WSP2 places the edge of the bridge opening at the bank station and extends the width from that point. In other words, WSP2 uses all the channel before any part of the flood plain.

Once the ratio of conveyances is found, the loss coefficients (K) are obtained from equations derived for each curve in figures 6, 7, and 10 in the BPR Manual. Loss for flow eccentricity is ignored. The equations represent the curves very accurately, with the exception of the pier equations. The pier curves are represented by linear equations and are not very precise below a ratio of pier area to total bridge area of about 0.02. The pier curves are shown in figure 7 in the BPR Manual. They extend to a pier K value of 0.4, which is the maximum allowed in the computer program.

The use of the curves in figure 6 in the BPR Manual should be as follows. The bottom curve (No. 1) is for all spillthrough

abutments, for all abutments with angles between 45 and 60 degrees, and for all bridges with openings more than 200 feet wide. The upper curves are for less efficient abutment angles. The middle curve (No. 2) should be used for angles that approach 30 degrees. The top curve (No. 3) should be used for angles that approach 90 degrees.

If the pier is not oriented parallel to the direction of water flow, the input value used for pier width is the projected pier width (see page 15 of the BPR Manual). For some bridges this would completely close off the opening, which is obviously unrealistic. Therefore, the maximum projected pier width used should be about three times the actual pier width.

WSP2 uses equation 30 on page 95 of the BPR Manual for the basic loss relationship. This equation states that head loss equals the total backwater loss coefficient times the velocity head within the bridge plus the difference between the exit and approach velocity heads. The head loss is assumed as previously described. WSP2 calculates the loss coefficient and exit and approach velocity heads, uses equation 30 to determine the velocity head within the bridge, and calculates velocity (V) through the bridge from the bridge velocity head. The bridge capacity for the assumed loss is then found from the continuity equation ($Q = AV$), where A is the area within the bridge below the tailwater elevation.

The lengths important to bridge analysis are found in the input as follows:

1. The reach length on the ROAD card is the distance from the road centerline to the exit section.
2. The reach length on the approach section REACH card is the distance from the approach section to the centerline of the road.

Some bridges restrict flow to the extent that flow passes through critical in the bridge section. Such bridges are illustrated in figure 4 in the BPR Manual. If flow approaches critical in the bridge section (Froude number is 0.8 to 1.2), WSP2 uses equations 25 and 26 on pages 57 and 58 of the BPR Manual to compare the energy level for flow at the approach section (assuming the headwater as described previously) with the energy level in the bridge section (assuming critical flow). At the same time, subcritical flow is computed as described above.

If the two specific energies balance before obtaining enough head to cause the required flow under subcritical conditions, the solution is assumed to be critical. Flow always is assumed to be critical if the Froude number is more than 1.2, in which case the energy levels are computed as above without regard to the subcritical flow calculations. The headwater is taken as the elevation at which the specific energies of the two sections balance. If the headwater elevation is subcritical at the bridge entrance, the headwater elevation is set equal to the critical elevation.

Culvert loss analysis

In one road restriction WSP2 can analyze losses through as many as five culvert openings of different shapes or elevations or an unlimited number of culvert openings with the same configuration. Only rectangular, circular, and standard metal-pipe arch shapes can be analyzed. The capability to analyze open channel flow in multiple culverts with different configurations has caused the solution to be a double trial-and-error procedure.

The problem is to find the amount of flow that will go through *each* culvert for the head loss increment or headwater elevation assumed in step 2 of the section Road Restriction Analysis. WSP2 solves the problem as follows:

Step 1.—Assume a discharge.

Step 2.—Compute an open channel flow profile from the tailwater point through the culvert with the assumed discharge. Solve for open channel flow by the direct step method using the reach length found for a change in depth of 0.2 foot. If this extends the profile past the upstream end of the culvert, WSP2 interpolates the water surface at the entrance and adds an en-

trance loss. If this water surface elevation does not closely match the headwater elevation (step 2, Road Restriction Analysis), WSP2 assumes a new discharge and repeats this step.

Step 3.—If open channel flow is impossible for this headwater elevation, WSP2 assumes full flow. For full flow the water surface elevation at the culvert entrance for the assumed discharge is found from a form of the equation

$$Q = A\sqrt{\frac{2gh}{\Sigma \text{ losses}}}$$

If this water surface elevation does not closely match the headwater elevation (step 2, Road Restriction Analysis), WSP2 assumes a new discharge and repeats this step.

Step 4.—The headwater elevation is found assuming inlet control. The water surface elevation required to pass the assumed discharge through the culvert entrance is found from a numerical representation of the nomographs in exhibits 14-6 through 14-13 of chapter 14 of NEH-4. If this water surface elevation does not closely match the headwater elevation (step 2, Road Restriction Analysis), WSP2 assumes a new discharge and repeats this step.

Step 5.—The discharge that will pass each culvert opening at the assumed headwater elevation is the lowest discharge derived from the computations of open channel flow, full flow, and inlet control.

Step 6.—If there are identical culverts, WSP2 multiplies the discharge from step 5 by the number of culverts that are identical.

The lengths important to the culvert analysis are found in the input as follows:

1. The reach length on the ROAD card is the distance from the downstream end of the culvert to the exit section.
2. The third data field of the CULV2 card gives the culvert length.
3. The reach length on the approach section REACH card is the distance from the approach section to the upstream end of the culvert.

Contracted opening bridge loss analysis

The WSP2 computer program can analyze bridge losses by a contracted opening method based on the following equation:

$$Q = C(CA)\sqrt{\frac{2gh}{1-\left(\frac{CA}{AA}\right)^2}}$$

where C is the coefficient of discharge, CA is the area within the contracted section, and AA is the approach section area.

The C value at most bridges ranges from 0.7 to 0.9. If flow turbulence approaching the bridge opening is relatively low, C value is about 0.9. If flow turbulence is high, C value may be as low as 0.4 to 0.5. In determining C value, consider the following: (1) shape of abutments (square cornered or shaped to reduce turbulence); (2) number and shape of piers; (3) degree of skew; (4) number and spacing of pile bents (closely spaced bents increase turbulence); (5) presence of trees, drift, or other obstructions at or approaching the bridge; (6) C value may decrease as discharge increases.

Evaluation of Acres Flooded

For any reach, information for three types of flooded areas can be found. The three types are damage (D), nondamage (N), and channel (C) areas. The letter designation D, N, or C on the segment definition cards determines in which category a segment will be placed. The total flooded area for the reach is the total width flooded times the flood-plain length (Field 5 on the reach card). The total channel area is the sum of the width of each channel times the channel length (Field 6 on the reach card). The nondamage area is the total nondamage width flooded times the flood-plain length (Field 5). The damage area is then the total flooded area minus the nondamage area and the area in channels.

Limitations

This section indicates important limitations of WSP2. If a given problem demands more accuracy than these limits allow, a different method of solution must be used.

Because data entry was made as easy as possible, WSP2 cannot check for many sources of input errors. For example, the capability of sorting the cross section station-elevation points precludes WSP2 from checking the integrity of station values. The surveyor, coder, and key-puncher must get correct data on the input cards.

When supercritical flow occurs, WSP2 uses the elevation that corresponds to critical depth for that profile at that section and continues upstream in this manner until subcritical flow recurs. WSP2 does not recompute downstream to determine supercritical flow elevations.

Critical depth is found by using the equation

$$\frac{Q^2}{g} = \frac{A^3}{T}$$

This relationship is valid for irregular, single-segment valley cross sections. It does not give the water surface elevation for multisegmented sections where energy is minimum. Errors of as much as 2 feet can occur, compared with the minimum elevation shown on a specific energy diagram, because of the area-top width relationship.

The WSP2 energy balancing procedure assumes *gradually* varied flow in a reach. Furthermore, since only friction loss is considered, it is essential that velocity changes in a reach be small. Since WSP2 is based on the law of conservation of energy, the limits of gradually varied flow should be related to kinetic energy (velocity head) rather than directly to velocity. If velocities in a reach are less than 6 ft/sec, the maximum change in velocity head would be about 0.5 foot. Certain evaluations could be significantly affected by this change, but they would normally be within the degree of accuracy of other hydrologic estimates.

If velocities are between 6 and 11 ft/sec, answers should be carefully examined to determine their adequacy. At a velocity of 11 ft/sec, the maximum change in velocity head would be about 2 feet. This is also the point at which critical depth computations are inaccurate. Therefore, answers that include velocities of 11 ft/sec or more should be carefully verified.

Important limitations to the BPR bridge analysis procedure are: (1) the channel in the vicinity of the bridge must be nearly straight; (2) cross sectional area of the stream must be fairly uniform; (3) stream gradient between the exit and approach sections must be approximately constant; (4) flow must be free to contract and expand; (5) no appreciable scour can be present at the bridge; (6) flow must be subcritical.

WSP2 culvert analysis is limited to rectangular, circular, and standard arch shapes. A culvert that is deformed by settlement, partially filled with sediment, or of a different shape must be represented by one of the three standard shapes. Of all parameters estimated, a close similarity should be maintained between the actual area and the area of the culvert chosen as most representative.

The mysteries of computer processing along with the form of computer output sometimes suggest more accuracy than is justified. When examining WSP2 output, consider the following limitations:

1. Accuracy of estimated input parameters. A Manning's roughness value can be estimated to be 0.04. Over a period of time it may range from 0.025 to 0.045. This might correspond to a variation in water surface elevation of —0.3 to +0.1 foot.
2. Precision of technical procedures applied to input data. For instance, since energy is balanced to the nearest tenth of a foot, a digit in the hundreth position has little meaning.
3. If an IBM computer is used for processing, 32 bits are used to store a number. This limits the maximum number of significant digits that can be stored to seven. Decimal-to-binary and binary-to-decimal conversion routines and the normal use of arithmetic functions further limit computer accuracy to five or six digits.

Input

Control words in columns 1 through 10 of the input cards direct the storage of data and the operation of the program. Spelling must be exact, but the user can insert blanks in control words as desired. If data are entered that are not needed, they are simply ignored. Some data are optional. For example, if acres flooded information is unimportant only the first two length fields on the reach card need to be coded.

WSP2 disregards blanks inserted within digits. For example, both 2379bbbbbb and b237b9bbbb are read as 2379.0 (b represents a blank column in an input field). If the correct input is 23.79, the user must insert the decimal point.

Card Entry Order

The major requirement is that all data needed to perform a compute instruction must precede the COMPUTE card. The order of REACH and ROAD cards establishes the order of computations that follow after a COMPUTE card is read. The user must place these cards in the desired order but the cards need not be adjacent to each other in the input deck. The input cards that must be in a specific location are:

1. The first card of any job must be a WSP2 card.
2. REACH and ROAD cards must be in the order of computation.
3. For bridge openings, the BPR or CONTR card must be first. If a PIER card is used, it must follow the BPR card. The GIRDER cards must be last in the set, followed by an END TABLE card.
4. A CULV2 card must follow each CULV1 card.
5. An NVALUE card must follow each SEGMENT card.
6. A REACH2 card (if used) must follow the REACH card. Since the flood-plain velocity option is not yet operational, the REACH2 card should be used only if the valley section of that reach has the same shape as the valley section of another reach. The valley section that is displaced and copied can be either upstream or downstream from the reach under consideration.
7. All information necessary to compute profiles, such as DISCHARGE, STARTE, TRIB, etc., for a given compute must precede the COMPUTE card.
8. A LINK card must be used if a job exceeds a combined total of 50 reach and road sections. The section that precedes

GENERAL INPUT DATA CATEGORIES

I. Preliminary data
   - A. WSP2
   - B. TITLE
   - C. DISCHARGE
   - D. STARTS OR STARTE
   - E. TRIB
   - F. OUTPUT

II. Length and drainage area data
   - A. REACH
   - B. REACH2
   - C. ROAD

III. Cross section data
   - A. SECTION
   - B. SEGMENT
   - C. NVALUE

IV. Bridge data
   - A. SECTION
   - B. BPR
   - C. PIER
   - D. GIRDER
   - E. CONTR

V. Culvert data
   - A. SECTION
   - B. CULV1
   - C. CULV2

VI. Miscellaneous
   - A. COMPUTE
   - B. LINK
   - C. CHANGE—END
   - D. ENDJOB-ENDRUN
   - E. COMMENT

the LINK card must be identified on a TRIB card.

9. An END card must follow the cards associated with a CHANGE card.

Updating

When updates are made the old data are not saved. For example, update section main 5 replaces data for old main 5. The old data points are lost. Any piece of input data can be updated. Most common is updating of cross section coordinates to reflect channel improvement. This usually requires updating the corresponding segment data and, if channel lengths were shortened, the reach file. Updating is done as follows:

1. CHANGE BRIDGE.—This is used to update BPR, CULVERT, CONTR, or PIER data.
2. Any third, fourth, etc., TITLE card updates the second TITLE card. A CHANGE card is not needed.
3. CHANGE DISCHARGE.—All the discharge file is lost, so all new discharge values must be entered.
4. STARTE or STARTS.—This information can be updated without using a CHANGE card if a new cross section name is used. If the same section name is used, a CHANGE STARTE or CHANGE STARTS card must be used.
5. CHANGE SEGMENT.—N-values must be re-entered. Segments within the same cross section can be updated independently of each other.
6. CHANGE REACH *From* (XSEC) *To* (XSEC).—If *From* (XSEC) and *To* (XSEC) are both filled in, then all cross sections between (including the *From* (XSEC) and *To* (XSEC) sections are replaced with the new reach cards that follow. If only the *From* (XSEC) is filled in, any reach cards that follow are inserted immediately after the reach listed.
7. CHANGE SECTION.—If the section name(s) that follows this card is in the file, the data are replaced. If the section name is not in the file, these cross section data are added to the file.
8. CHANGE TRIB.—All the TRIB file is replaced by new names entered.
9. An END control card *must* follow the last data for all updates.

Editing

All input data are edited for detectable errors when they are read. The two types of detectable errors are:

1. *Warning errors* that may not result in erroneous answers, so computations continue.
2. *Fatal errors* in data that must be corrected. When this type of error is detected, computations will not proceed. The program continues to edit the data as much as possible in order to detect additional errors.

Other errors can be detected only when computations are being performed. All error messages are made to stand out by asterisks. For example,

*******BLANK IS NOT ALLOWED IN FIELD NO. 5**********

Careful study of the section on output error messages will provide many ideas as to data requirements.

Input for Given cfs Values

Two methods can be used to determine flow rates at each cross section. One method uses csm (cubic feet per second per square mile) values as input which are then converted to cfs (cubic feet per second) values by the computer program. The other method, based on direct input of cfs values by the user, is explained in the following example, which shows the discharge and reach cards for a job using given cfs values.

Discharge	—2	0.7	0.9	1.0	1.2	1.5
Reach	1	1,375	0.0	0.0		
Reach	2	1,345	450	450		
Reach	3	1,290	700	700		

Five profiles are calculated. At valley section 1 the discharges are:

Profile 1 0.7 x 1,375 = 962 cfs
Profile 2 0.9 x 1,375 = 1,238 cfs
Profile 3 1.0 x 1,375 = 1,375 cfs
Profile 4 1.2 x 1,375 = 1,650 cfs
Profile 5 1.5 x 1,375 = 2,062 cfs

At valley section 2 the discharges are 0.7, 0.9, 1.0, 1.2, and 1.5 times 1,345.

Output

An 80/80 list of all input data is printed first (see sample output on page 31). The end of the input list is noted "END of 80/80 LIST." This means that a COMPUTE card has been encountered and computations will follow. The standard output (valley section and bridge rating tables) appears next. Requested optional output (segment and KD tables and rating curve plots) is intermixed with the rating tables. Only one KD table and rating curve plot is reproduced in the sample.

The velocity under the total column in the segment table is a weighted velocity. It is the velocity that, when squared and divided by 2g, yields the velocity head (see step 3, Valley Section Analysis). Stated another way, it is the average section velocity adjusted (usually increased) for nonuniform velocity distribution within the valley section.

Each output sheet has its own page identification. The standard output contains only the page number. The other sheets contain the same number plus a letter identification. K for KD table, P for plotted rating table, and S for segment information table. All output sheets pertaining to the same cross section have the same page number. The title part of the identification is indicated by the input title cards. The points on the plotted rating table are labeled 0 for lowest cross section elevation, 1 to 9 for profiles 1 to 9, and A to F for profiles 10 to 15.

The cost to run the sample job on the USDA computer (IBM 370 model 168) in Washington, D.C., was approximately $17: 22 percent for reading data; 8 percent for building the section tables of elevation versus KD, Q_{crit}, etc.; 8 percent to balance energy between the valley sections; 1 percent to analyze the bridge; 33 percent to analyze the culverts; and 28 percent to print the output (of which 1 percent was for printing the rating curve plots).

Helpful Hints

Quite often it is necessary for someone other than the person who prepares the input to study the output. For a person unfamiliar with the data, it is much easier to find specific pieces of information if a set input pattern is followed. Therefore, the pattern shown in the sample job is recommended. The standard forms can aid in coding input in this manner.

The sample job was put together as follows: The information on form SCS-ENG-16 was put first. The complete reach and road file was put next on a general input form. The complete reach and road file should be put here even if the section information is split by LINK cards. This was followed by the SECTION and BPR or CULV information in the *upstream* order of appearance in the valley. The last information was COMPUTE information followed by ENDJOB and ENDRUN cards.

WSP2 requires a large amount of input data. The user should make every possible check to eliminate errors. Use of the sort-routine precludes WSP2 from checking for correct station (x) values. Section 90963 in the sample job is a good example of the use of the sort-routine. After the section was coded, it was noted that elevation at the first end of the section was inadequate The user coded a point at the end of the section that WSP2 placed at the beginning of the section. A warning message stating

that the points have been reordered is expected and the —25. station that should be a +25. will likely never be detected. It is a significant error but not significant enough to be seen from normal checks on output, such as a rating curve or profile plots. A plot of the valley section input data is an excellent data check. A separate plot program is available.

Reach length is defined differently in WSP2 than in some previously used SCS computer programs. In WSP2, the hydraulic length of channels and flood plains is measured from the section under consideration to the next *downstream* section.

A few coding and keypunch errors can be eliminated if optional information is omitted. For example, the elevations on segment boundary points can be left off if the station value is unique.

The name of roads and reaches should contain no more than six characters because this is all that is retained by the program.

Examine all WSP2 output to determine the adequacy of the answers. Use USGS rating curves, flood profiles, and all other available information to check WSP2 ratings. Pay careful attention to BPR bridge head losses and to valley section ratings, particularly if velocities exceed 11 ft/sec. Note that a water surface reversal occurs in the sample output between sections 92397 and 92100. This is due to a large change in velocity head. When this occurs, compare the input data and the physical situation to determine the cause and proceed accordingly.

Always request the segment table if you run seven or fewer profiles. This generates no more pages of output and adds only minimal cost for printing. The KD table that gives values at even foot increments should rarely be needed because KD values at profile point elevations are provided in the segment table.

The largest single cost in the sample job was to analyze the head loss through the two culverts. The following information is intended to help eliminate *unexpected* large costs for culvert analysis. The cost of analyzing the head loss through a road restriction with culverts depends mainly on (1) the number of profiles being processed, (2) the amount of head loss for each profile, (3) the type of culvert being analyzed, and (4) the number of openings of different configuration.

On the USDA computer in Washington, D.C., cost of analysis is generally 8¢ per foot of head loss through a box culvert. A circular culvert costs about 2.5 times more and a pipe arch culvert costs about 16 times more to analyze than a box culvert. Therefore, a job running two profiles through one circular culvert having losses of about 2 feet (1st profile) and 3 feet (2nd profile) would cost about 20¢ (2.5 times 8¢) per foot of head loss. The total loss is 5 feet, and thus the total cost would be about $1.

If necessary, costs can be reduced by converting arch culverts to rectangular culverts of equal area, or several dissimilar culverts can be run as a battery of identical culverts of equal area.

If you are in doubt as to whether a restricted opening should be analyzed as a bridge or a culvert, analyze the opening as a culvert. Culvert loss analysis is more reliable than the BPR bridge loss analysis. Therefore, if there is a choice, call the opening a culvert.

Output Error Messages

The following explanations of error messages should help you determine the exact cause of a particular problem.

ABUTMENT TYPE IS BLANK. DEFAULT IS A.

The BPR abutment type should be A or B. The program assumes an A if this field is left blank.

BLANK IS NOT ALLOWED IN FIELD NUMBER XX.

Certain data fields cannot be left blank. If zero is intended, the zero must be included and punched in the card. This is because certain types of data must be present for the program to be run. The absence of data would indicate an oversight or an error.

BRIDGE HEADWATER BELOW CRITICAL DEPTH ON APPROACH SECTION. HEADWATER PRESUMED AT CRITICAL.

The depth of water at the upstream face of the bridge (bridge headwater elevation) is less than critical depth at the same location. This occurs if the bridge opening and exit section have much more discharge capacity than the approach section related to the same depth.

CARD OUT OF SEQUENCE—FATAL.

The program expected a girder card or a CULV2 card.

CROSS SECTION NAMED XXXXX WAS NOT IN THE FILE, OR JOB DELETED.

In attempting to update the reach file, one of the cross sections named in the *From* XSEC or *To* XSEC was not in the file. These cross sections must have been included in the old reach file prior to an update.

CROSS SECTION XXXXX DOES NOT HAVE A SEGMENT NUMBER XX.

Segments must be numbered consecutively. For example, if segments are numbered 1, 2, 4, and 5, WSP2 lists segment 3 as missing.

CROSS SECTION XXXXX DOES NOT HAVE SEGMENT FILE.

WSP2 found no segment file for the named cross section. It could be that the section is to be a bridge. If so, then bridge data are also missing.

CROSS SECTION XXXXX HAS TWO SEGMENTS NUMBER XX.

In trying to set up the segments for this cross section, the program found two segments with the same number; the first segment found with this number is used, and the other is disregarded.

CROSS SECTION XXXXX WAS NOT IN THE FILE.

The named cross section was not in the section file. The cross section either was not entered or an error was made in punching the name.

DATA POINTS REORDERED BY PROGRAM ACCORDING TO X VALUES, OR DUPLICATE X POINTS NOT CHANGED.

This means that the sort-routine was used to put station (x) values in order of increasing magnitude.

ERROR—THIS STARTING DATA NOT YET COMPUTED.

The starting elevations were to have been computed and retained. However, the required cross section has not been used in any previous COMPUTES.

ERRORS DETECTED IN DATA, CHECK RESULTS CAREFULLY.

The editing process has detected a possible data error. Processing will continue but may be erroneous. The source of the possible error appears in the output that precedes this message and may lead to a fatal error later.

FATAL ERROR DETECTED IN DATA, LIMITED EDITING CONTINUES.

The editing detected a definite data error. Processing will not continue, but limited editing of the remaining data will continue. The source of the error appears in the output that precedes this message.

GIRDER POINTS DO NOT MATCH ROADWAY ON BRIDGE.

The program matches the first and last points on the girder card with points on the roadway card in order to separate the road section into weirs and to get bridge-opening areas. The x-values are the ones that must be matched. The road section did not contain any x-values corresponding to the first and last girder x-values.

IMPROPER COMBINATION OF N-VALUES AND RADIUS ON SEGMENT NUMBER XX XSEC NUMBER XXXXX.

The number of n-values provided for a segment in the input data must be equal to or one greater than the number of hydraulic radii provided. The program deletes n-values until this is true. Deleted n-values are the last ones entered in the data.

INVALID CHARACTER IN FIELD XX ON THE ABOVE CARD.

The field named in the card listed above has an invalid character. A letter appears in a field that can have only numbers or some other nonnumeric digit. Check card and control words to determine correct notation for this field.

LAST POINT ON SEGMENT XX DOES NOT MATCH ANY POINT ON CROSS SECTION XXXXX.

The data point named as the last station and last elevation on a segment card must correspond to one of the survey points for this cross section.

MAX ELEV DIFFERENCE BETWEEN POINTS EXCEEDS XX FEET.

Difference in elevation between two succeeding cross-section coordinates is more than XX feet. WSP2 will default XX to a value of 20 feet unless specified otherwise on the WSP2 card. A check for a coding or keypunching error should be made before accepting these data as correct.

MORE THAN XXXX ESTIMATES OF EWS MADE, SOLUTION TAKEN AT THIS POINT.

WSP2 builds a headwater table on increments of 0.1 foot for a bridge and 0.2 foot for culverts. If a solution that provides a sufficient amount of discharge through the opening has not been found after 250 tries, an error in input data is likely.

NO NVALUE CARD FOR SEGMENT XX OR SECTION XXXXX.

WSP2 expects an NVALUE card to follow a SEGMENT card. The NVALUE card either is missing or has no data punched in it.

NO SOLUTION AFTER 1,000 TRIES*** GIVE UP, TAKE THIS ANSWER. ***EWS=

WSP2 made 1,000 trials to determine estimated water surface elevation at the head of the reach. The last three trials have been printed. The last figure printed is taken as an answer and processing continues. This figure may or may not be correct. To check, the user should compare the last three values printed.

NUMBER OF BRIDGE SECTIONS EXCEEDS LIMIT.

WSP2 accepts only 25 bridge sections on BPR, CONTR, or CULV cards. Bridge cards that have the same road name are considered to be the same bridge section.

NUMBER OF SECTIONS EXCEEDS FILE SIZE. THIS SECTION NOT RETAINED.

WSP2 can hold data on 50 cross sections entered on SECTION cards. If more are entered, WSP2 simply ignores them. This may cause an error message later in the calculations, indicating that a particular section is not in the file.

NUMBER OF STARTING VALUES LESS THAN NUMBER OF PROFILES TO BE RUN.

The number of profiles to be run under the current COMPUTE card (determined by number of values entered by a DISCHARGE card) is more than the number of values in the starts, starte, or trib file for the cross section. Critical depths will be used for all starting values.

PROFILE NO XX EXCEEDS SURVEY DATA.

The water surface elevation at which energy balanced was higher than the lowest of the two section end points.

REACH—NAMED XXXXX IS NOT IN THE REACH FILE.

The cross section name XXXXX that appears in the first field in the COMPUTE card has not been located in the reach file. This cross section either has not been named as a reach and has been omitted from the reach file or the name in this compute is incorrect.

SEGMENT NUMBERS DO NOT MATCH ON THE ABOVE UPDATE.

In updating a cross section that has segments numbered 1, 2, 3, and 4, the updated segment must be one of these numbers.

SEGMENTS X AND X OVERLAP ON SECTION XXXXX.

The end-point value specified for a segment is smaller than the end-point value specified for a segment that has a smaller segment number. For example, segment number 1 ends at station 600; segment number 2 ends at station 400.

THE ABOVE CARD IS OUT OF ORDER, OR DATA IS NOT RETAINED FOR USE.

Certain cards must follow other cards. For example, an NVALUE card must follow a segment card. The data on a card that is out of order are lost. This error may not be fatal at this point but will probably be fatal before the run is through.

THE CROSS SECTION NAMED XXXXX WAS NOT IN THE FILE FOLLOWING CROSS SECTION NAMED XXXXX, OR JOB DELETED.

In an attempt to update the reach file, the *To* XSEC was not in the reach file after the *From* XSEC was located. In updating the reach file, both the *From* XSEC and *To* XSEC must be in the old file.

TOO MANY CROSS SECTION POINTS. EXTRA DISREGARDED.

The program will hold 48 points per cross section. If more are entered, the last points read in are disregarded. If the points are not entered in order from left to right, the last points read in may not be the rightmost points.

TOO MANY SEGMENTS FOR THIS SECTION.

More than six segments have been named or entered for this cross section. The limit is six. Only the first six are used.

TOO MANY TRIBUTARY NAMES GIVEN—ONLY THE FIRST 15 ARE USED.

Only 15 starting elevations or starting slopes can be given.

TOO MANY TRIBUTARY NAMES GIVEN—STARTING DATA WILL BE HELD FOR ONLY THE FIRST 20.

The program can hold values for only 20 tributaries.

TOO MANY VALUES GIVEN FOR DISCHARGE—ONLY THE FIRST 15 ARE USED.

The program can run only 15 profiles at one time. If more than 15 values for discharge are entered, only the first 15 are retained.

TYPES OF STARTING INFORMATION MAY NOT BE MIXED ON THE SAME CROSS SECTION.

A STARTE card has been entered following a STARTS card with the same cross section name, or *vice versa.* If either elevations or starting slopes are given for one profile, they must be given for all profiles. The last type entered is the one retained by the program. Later in the calculations this may cause an unequal match between the number of profiles and the number of starting elevations.

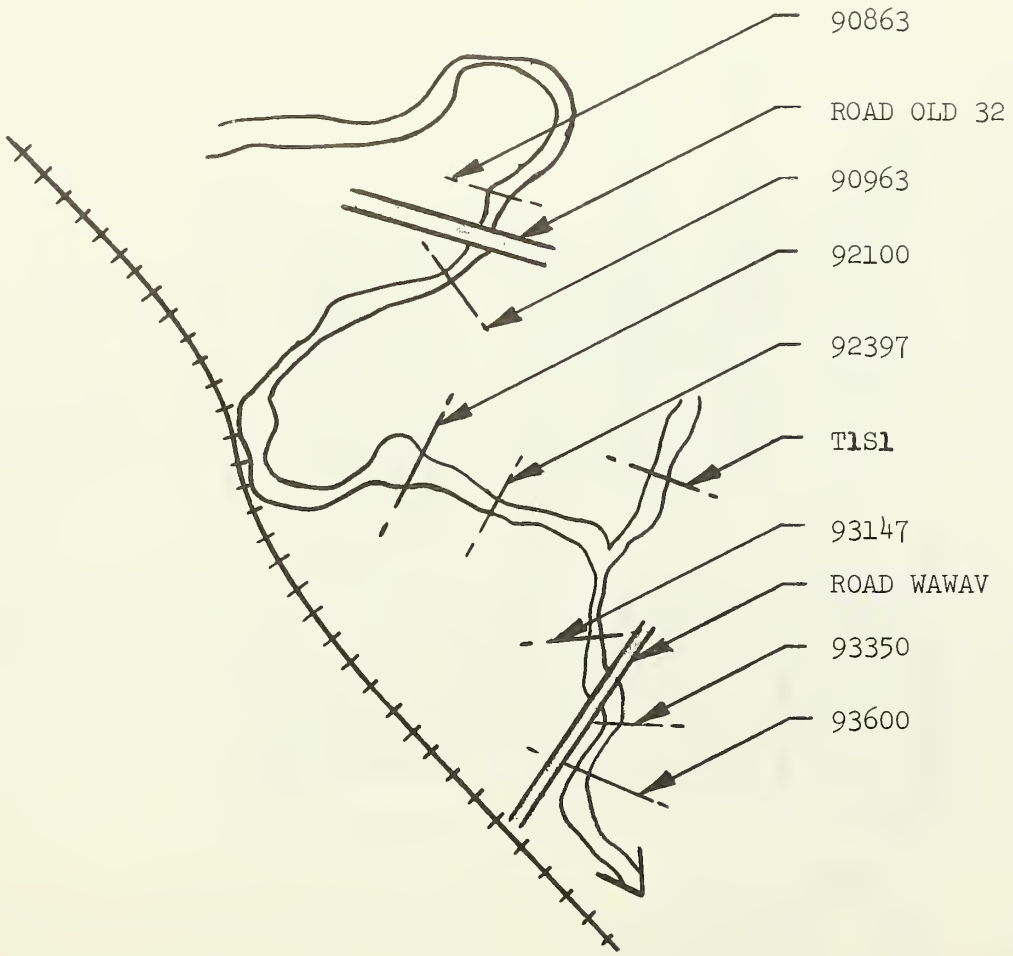
XSEC ON CURRENT COMPUTE CARD CANNOT BE A BRIDGE.

The cross section named in the *From* XSEC or *To* XSEC field on a compute card may not be a bridge name because each bridge must have both an exit section and an approach section. Therefore, all profiles must start and end on a section other than a bridge section.

Sample Job

The following sample job shows how data are organized and what answers can be expected from the program. The sample job includes five profiles run through eight valley sections (one of which is on a tributary) and two road restrictions. One road restriction has a bridge-type opening; the other has two culverts. The sample job shows each kind of standard input form. For a complete input-data list, see the 80/80 list in the sample output. Standard input forms are available through the USDA Central Supply office.

For a detailed description of the data that go in each field on the input data cards, see the back of the input forms. The reach and road information appears on a general coding form. Data for these cards are described on the back of forms SCS-ENG-17 and 18.



Yantic River, Connecticut

SCS-ENG-16
REV. DEC. 1974

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

WATER SURFACE PROFILE INPUT DATA

YANTIC RIVER (JOB OR PROJECT) BY S. FOX CHECKED O. LEE DATE 5-9-75

Control Word	Data Fields 1	2	3	4	5	6	Card Ident.
	DELTA ELEV.						
WSP2	12						
	ANY ALPHAMERIC TITLE WILL BE PRINTED AT TOP OF EACH PAGE MAY NOT BE CHANGED IN JOB						
TITLE	YANTIC RIVER			WS-NORWICH, CONN. FHS			
	ANY ALPHAMERIC TITLE WILL BE PRINTED AT TOP OF EACH PAGE MAY BE CHANGED AT ANY TIME						
TITLE	FLOOD HAZARD STUDY - FUTURE COND., MARCH 1973						
	TOTAL D. A.	CSM	CSM	CSM	CSM	CSM	
DISCHARGE	96.10	50.	90.	125.	220.	300.	
~~DISCHARGE~~							
DISCHARGE							
	XSEC NAME	SLOPE	SLOPE	SLOPE	SLOPE	SLOPE	
STARTS							
STARTS							
~~STARTS~~							
	XSEC NAME	ELEVATION	ELEVATION	ELEVATION	ELEVATION	ELEVATION	
STARTE	93600	90.90	94.15	96.88	101.99	105.45	
~~STARTE~~							
~~STARTE~~							
	XSEC NAME	XSEC NAME	XSEC NAME	XSEC NAME	XSEC NAME	XSEC NAME	
TRIB	93147						
~~TRIB~~							
TRIB							
~~TRIB~~							
	OUTPUT OPTIONS						
OUTPUT	SPK						
	~~ANY ALPHAMERIC MESSAGE~~						
COMMENT							
	SAME AS COMMENT						
*							

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WSP2			RESETS ALL PROGRAM VARIABLES TO PROGRAM DEFINED VALUES FOR BEGINNING OF A NEW JOB. THIS MUST BE THE FIRST CARD OF A JOB.
	DELTA ELEV	11-20	MAXIMUM ELEVATION DIFFERENCE BETWEEN X-SECTION COORDINATES WITHOUT A CAUTION STATEMENT RESULTING IN PRINTOUT. DEFAULT IS 20 FEET.
TITLE		11-70	ANY ALPHAMERIC DATA. THE FIRST TITLE ENTERED WILL BE RETAINED FOR THE ENTIRE JOB, AND WILL BE PRINTED AT THE TOP OF EACH PAGE. IT MAY NOT BE ALTERED. THE SECOND TITLE ENTERED WILL ALSO BE PRINTED AT THE OF EACH PAGE. IT MAY BE ALTERED AT ANY TIME.
DISCHARGE			ENTERS BASIC CSM VALUES TO BE USED.
	BASIC DRAINAGE AREA	11-20	THE DRAINAGE AREA AT THE LOWER END OF THE WATERSHED. (SEE NOTE).
	CSM	21-30 31-40 41-50 51-60 61-70	THE CSM VALUES FOR EACH PROFILE DESIRED. THESE VALUES SET THE ORDER OF COMPUTATIONS. I.E. THE FIRST CSM VALUE ENTERED IS THE FIRST PROFILE RUN. UP TO 3 CARDS MAY BE USED.
STARTS			SAME AS STARTE EXCEPT THAT SLOPES IN FT/FT ARE ENTERED INSTEAD OF ELEVATIONS.
STARTE			USED TO ENTER THE STARTING ELEVATIONS FOR EACH PROFILE TO BE RUN. UP TO 3 CARDS PER SECTION MAY BE USED BUT ONLY ONE SECTION MAY BE ENTERED AT ONE TIME.
	XSEC NAME	11-20	THE NAME OF THE CROSS SECTION FOR WHICH THE STARTING ELEVATIONS APPLY. THE NAME MUST BE ENTERED IN EACH CARD USED.
	ELEVATION	21-70 BY 10 COL. FIELDS	THE STARTING ELEVATION FOR EACH CSM. THE FIRST ELEVATION ENTERED REFERS TO THE FIRST CSM ETC.
TRIB		11-70 BY 10 COL. FIELDS	THE NAMES OF CROSS SECTIONS WHERE DATA ARE TO BE HELD FOR USE AS STARTING DATA ON LATER PROFILES. THESE NAMES CANNOT BE ROAD NAMES. UP TO 20 NAMES MAY BE USED.
OUTPUT			THIS CARD SETS THE OUTPUT SWITCHES FOR THE TYPE OF OUTPUT DESIRED. EACH TIME AN OUTPUT CARD IS ENTERED ALL PREVIOUS OUTPUT OPTIONS ARE TURNED OFF. THE PRINTED VALLEY SECTION AND BRIDGE RATING TABLES ARE STANDARD OUTPUT.
	OUTPUT OPTIONS	11-20	R - PUNCH RATING TABLE FOR INPUT TO HYDROLOGY PROGRAM. P - PLOT RATING TABLES S - PRINT SEGMENT TABLE K - KD TABLE NOTE THESE OPTIONS MAY BE ENTERED IN ANY ORDER.
COMMENT	OR *		PROVIDES AN 80-80 LIST OF DESIRED COMMENTS ON THE OUTPUT LISTING OF INPUT DATA. DO NOT USE WITHIN GROUPS OF CARDS THAT GO TOGETHER SUCH AS SEGMENT AND NVALUE.
		11-70	THE DESIRED TEXT.

NOTE: AN OPTION HAS BEEN ADDED SO THAT A GIVEN PROFILE IN CFS CAN BE RUN. TO DO THIS INPUT A NEGATIVE VALUE FOR BASIC DRAINAGE AREA. ENTER THE CFS VALUE FOR EACH REACH IN PLACE OF THE DRAINAGE AREA ON THE REACH CARD. THEN PUT A VALUE OF 1.0 FOR THE FIRST CSM VALUE. IF PROFILES WITH CFS VALUES RATIOED UP OR DOWN FROM THE GIVEN VALUES AT EACH SECTION ARE DESIRED, THESE RATIOS CAN BE LISTED IN PLACE OF CSM VALUES.

NOTE: NAMES MAY CONSIST OF FROM 1 to 6 ALPHA NUMERIC CHARACTERS. IMBEDDED BLANKS ARE IGNORED SO A - SHOULD BE USED TO SEPARATE CHARACTERS IF DESIRED. THE NAME MAY BE ANYWHERE WITHIN THE NAME FIELD.

SCS-MGT-1
REV. 5-70
(FORMERLY SCS-287)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STANDARD 10 COLUMN INPUT DATA

YANTIC RIVER (JOB OR PROJECT) BY S. FOX CHECKED O. LEE DATE 5-9-75

1 2 3 4 5 6 7 8 9 10 | 11 12 13 14 15 16 17 18 19 20 | 21 22 23 24 25 | 26 27 28 29 30 | 31 32 33 34 35 | 36 37 38 39 40 | 41 42 43 44 45 | 46 47 48 49 50 | 51 52 53 54 55 | 56 57 58 59 60 | 61 62 63 64 65 | 66 67 68 69 70 | 71 72 73 74 75 | 76 77 78 79 80

Control Word	Data Fields 1	2	3	4	5	6	Card Ident.
REACH	9,36,0,0	89.90	0.0	0.0	225.		
REACH	9,33,5,0	89.71	250.	250.	175.		
REACH 2	9,31,4,7						
ROAD	WAWAV	2.7	50.	50.			
REACH	9,31,4,7	89.70	153.	153.	296.		
REACH	9,23,9,7	89.55	750.	750.	756.		
REACH	9,21,0,0	89.47	297.	297.	717.		
REACH	9,09,6,3	89.30	1137.	1137.	825.		
ROAD	OLD 32	2.7	50.	50.			
REACH	9,08,6,3	89.30	50.	50.	200.		
REACH 2	9,09,6,3						
REACH	T,I,S,I	6.7	700.	700.	850.		

Key Punch Operator: This Form Set Up For 10 - Column Skip With Exceptions As Noted. Left Justify Data In Open Fields.

This is a general purpose form for recording input data for any computer program. All of the project formulation programs being supported by the Central Technical Unit will be converted to this general format, i.e., the control word in Cols. 1-10, identification in Cols. 71-80 and data fields from Cols. 11-70, usually by col. of 10's. Line weights are varied on the form for accentuation.

LINE OUT ANY UNUSED CARDS ON THE FORM

SCS-ENG-17
REV. MAR. 1976

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

WATER SURFACE PROFILE INPUT DATA

YANTIC RIVER (JOB OR PROJECT) BY S. FOX CHECKED O. LEE DATE 5-9-75

Control Word	Data Fields 1	2	3	4	5	6	Card Ident.
	~~ROAD NAME~~	~~WEIR COEF~~	~~CHANNEL LENGTH~~	~~FLOOD LENGTH~~			
~~ROAD~~							
	ROAD NAME	SKEW TYPE	BASE CURVE	PIER CURVE			
BPR	WAWAV	A	3.	6.			
	BOTTOM ELEV	AVG WIDTH	BOTTOM ELEV	AVG WIDTH	BOTTOM ELEV	AVG WIDTH	
PIER	81.5	1.5					
	ELEV FULL	ELEV GRDR BOT	SKEW ANGLE	ORIF COEF	WEIR COEF		
GIRDER	92.5	91.7	0.	0.8	2.7		
	-117.	96.7	-113.	91.7	-5.	92.4	
	-5.	97.3					
ENDTABLE							
	~~ROAD NAME~~	~~NO. OF PIPES~~	~~CULV CODE~~				
CULV 1							
	DIA OR HEIGHT	*WIDTH	LENGTH	ELEV US INVERT	ELEV DS INVERT	CULV 'n'	
CULV 2							
CULV 1							
CULV 2							
CULV 1							
CULV 2							
CULV 1							
CULV 2							
CULV 1							
CULV 2							

ROAD			ENTERS THE ELEMENTS FOR A ROAD SECTION.
	ROAD NAME	11-20	THE NAME OF THE ROAD, EACH MUST BE UNIQUE. (SEE NOTE 1, SCS-ENC-19).
	WEIR COEF	21-30	THE COEFFICIENT TO BE USED FOR FLOW OVER THE ROADWAY (USUALLY 2.7).
	REACH LENCTHS	31-50	SEE CHANNEL AND FLOOD LENCTH DESCRIPTIONS ON THE REACH CARD. (SCS-ENG-18)
BPR			ENTERS DATA TO BE USED FOR COMPUTINC BPR BRIDCES
	ROAD NAME	11-20	THE NAME OF THE ROAD THAT THIS BRIDGE IS IN. (SEE NOTE 1, SCS-ENC-19)
	SKEW TYPE	21-30	A OR B ACCORDINC TO FIGURE 10 IN "BPR HYDRAULICS OF BRIDCE WATERWAYS, 1970".
	BASE CURVE	31-40	REFERENCE FICURE 6 "BPR HYDRAULICS OF BRIDGE WATERWAYS, 1970", CURVES ARE NUMBERED 1-3 FROM BOTTOM TO TOP ON FIGURE 6.
	PIER CURVE	41-50	REFERENCE ABOVE BPR MANUAL FICURE 7. CURVES ARE NUMBERED 1-8 FROM LEFT TO RIGHT.
PIER			DEFINES THE PIER SIZES IF PRESENT. (THIS CARD MUST FOLLOW THE BPR CARD IF USED). MAX OF 3 PIERS (1 CARD) MAY BE ENTERED. (IF MORE ARE PRESENT COMBINE DIMENSIONS).
	BOTTOM ELEV.	11-20,31-40,51-60	THE ELEVATIONS WHERE THE PIERS INTERSECT THE CHANNEL BOTTOM.
	AVC WIDTH	21-30,41-50,61-70	THE AVERACE WIDTHS OF THE PIERS (SEE FIGURE 7 BPR MANUAL).
GIRDER			DESCRIBES THE INDIVIDUAL ITEMS PERTAININC TO AN OPENINC (MUST FOLLOW CONTR OR PIER, IF PIER IS NOT USED IT MUST FOLLOW BPR.
	ELEV FULL	11-20	ELEVATION WHERE ORIFICE FLOW BECINS. BASED ON THE INDIVIDUALS BEST JUDCEMENT IT IS USUALLY SLIGHTLY ABOVE THE POINT WHERE THE CIRDERS ARE ALL SUBMERED.
	ELEV GRDR BOT	21-30	THE ELEVATION WHERE THE CIRDERS FIRST BECIN TO REDUCE FLOW AREA FROM THE CHANNEL.
	SKEW ANCLE	31-40	THE ANCLE OF THE FLOW IN DEGREES WITH THE PERPENDICULAR TO THE CENTER LINE OF THE ROADWAY.
	ORIF COEF	41-50	THE COEFFICIENT TO BE USED IN THE ORIFICE FLOW FORMULA WHEN ORIFICE FLOW CONTROLS.
	WEIR COEF	51-60	THE WEIR COEFFICIENT FOR FLOW OVER THE BRIDCE DECK. THIS IS COMPUTED SEPARATE FROM THE FLOW OVER THE ROADWAY PROPER.
	DATA CARDS 1-5	11-70 BY 10 COL. FIELDS	THE X AND Y COORDINATES ARE NEEDED TO DESCRIBE THE SHAPE OF THE BRIDCE CRIDER THESE POINT ARE USED TO DEDUCT NET FLOW AREA FROM THE SECTION WHEN FLOW ENCOUNTERS THE GIRDER. THE FIRST AND LAST GIRDER POINTS DEFINE THE WEIR WHEN FLOW OVERTOPS THE GIRDER. THESE ARE ENTERED X1, Y1, X2, Y2, ETC. THE FIRST AND LAST POINTS MUST COINCIDE WITH POINTS ON THE CROSS SECTION (ROAD). USE ONLY THE NUMBER OF CARDS ACTUALLY NEEDED.
ENDTABLE			INDICATES THE END OF A GIRDER TABLE.
CULV1			ENTERS DATA TO BE USED IN COMPUTING LOSSES THROUGH CULVERTS.
	ROAD NAME	11-20	THE NAME OF THE ROAD THAT THIS CULVERT IS IN. (SEE NOTE 1, SCS-ENC-19).
	NO OF PIPES	21-30	THE NUMBER OF IDENTICAL OPENINCS - NO LIMIT ON THIS NUMBER.
	CULV CODE	31-40	SELECT THE APPROPRIATE CODE FROM TABLE 1.
CULV2			THIS IS A CONTINUATION OF CULV1 AND 'MUST' FOLLOW IT.
	DIA OR HEICHT	11-20	THE DIAMETER OF A CIRCULAR CULVERT IN FEET OR THE HEIGHT IN FEET OF A BOX CULVERT OR PIPE ARCH.
	WIDTH	21-30	THE WIDTH IN FEET OF A BOX CULVERT OR PIPE ARCH.
	LENCTH	31-40	THE TOTAL LENCTH IN FEET OF THE CULVERT.
	ELEV US INVERT	41-50	THE ELEVATION OF THE UPSTREAM INVERT OF THE CULVERT.
	ELEV DS INVERT	51-60	THE ELEVATION OF THE DOWNSTREAM INVERT OF THE CULVERT.
	CULV 'n'	61-70	THE CULVERT 'n' VALUE, IF A VALUE OTHER THAN THAT ASSIGNED BY TABLE 1 IS DESIRED.

TABLE 1 CULVERT CODE TABLE

CORRUGATED METAL PIPE							CONCRETE PIPE OR BOX			
CIRCULAR					PIPE-ARCH		CIRCULAR		SQUARE EDGE R.C. BOX	
INLET TYPE	RIVETED 'n'=.021	RIVETED 25% PAVED 'n'=.021	STRUC. PLATE 'n'=.032	STRUC. PLATE 25% PAVED 'n'=.026	PAVED 25% 'n'=.026	UNPAVED 'n'=.032	INLET TYPE	CODE 'n'=.012	INLET TYPE	CODE 'n'=.012
PROJECTION	12311	12411	12111	12211	32211	32111	SOCKET-END PROJECTION	22551	30 TO 75 DEGREE WINCWALL FLAIR	41111
MITERED	13322	13422	13122	13222	33222	33122	HEADWALL	22552	90 TO 15 DEGREE WINGWALL FLAIR	41122
HEADWALL	12333	12433	12133	12233	32233	32133	SQUARE EDGE		PARALLEL WINCWALLS	41133
END SECTION	12335	12435					PROJECTION	22533		
BEVEL (A)	12346	12446	12146	12246			HEADWALL	22534		
BEVEL (B)	12347	12447	12147	12247			END SECTION	22535		
TAPERED	11348	11448					BEVEL (A)	22546		
							BEVEL (B)	22547		
							TAPERED	21548		

SCS-ENG-18
REV. MAR. 1976

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

WATER SURFACE PROFILE INPUT DATA

YANTIC RIVER (JOB OR PROJECT) BY S. FOX CHECKED O. LEE DATE 5-9-75

Control Word	Data Fields 1	2	3	4	5	6	Card Ident.
~~REACH~~	~~REACH NAME~~	~~DRAINAGE AREA~~	~~CHANNEL LENGTH~~	~~FLOOD LENGTH~~	~~DAMAGE LENGTH~~	~~CHANNEL LENGTH~~	
	XSEC NAME	DISPLACEMENT	VELOCITY				
~~REACH 2~~							
	XSEC NAME	SEGMENT No.	SEGMENT TYPE	LAST STATION	LAST ELEV		
SEGMENT	93600	1	D	-165.			
	'n'	'r'	'n'	'r'	'n'	'r'	
NVALUE	0.050						
SEGMENT	93600	2	C	-50.			
NVALUE	0.040						
SEGMENT	93600	3	D	660.			
NVALUE	0.050						
~~SEGMENT~~							
~~NVALUE~~							
SEGMENT							
NVALUE							
SEGMENT							
NVALUE							
	ROAD NAME	COEF OF CONTR					
CONTR							
	ELEV FULL	ELEV GRDR BOT	SKEW ANGLE	ORIF COEF	WEIR COEF		
GIRDER							
	STATION	ELEV.	STATION	ELEV.	STATION	ELEV.	
ENDTABLE							

NOTE: 2N VALUE CARDS CAN BE USED PER SEGMENT –4 SETS OF 'n'–'r' VALUES IS THE MAXIMUM

REACH		DEFINES THE ELEMENTS OF A REACH. THE ROAD AND REACH CARDS MUST BE IN THE ORDER OF COMPUTATIONS SINCE ONLY THE FIRST AND LAST SECTION NAMES ARE SHOW ON THE COMPUTE CARD.
REACH NAME	11-20	THE NAME OF THE REACH, EACH MUST BE UNIQUE. (SEE NOTE 1 SCS-ENG-19) THIS MUST BE THE SAME NAME AS THE CROSS SECTION TO BE USED, UNLESS FOLLOWED BY A REACH2 CARD.
DRAINAGE AREA	21-30	THE DRAINAGE AREA (SQ MILES) AT THE CROSS SECTION (REACH HEAD).
CHANNEL LENGTH	31-40	THE HYDRAULIC LENGTH OF THE MAIN CHANNEL SEGMENT (TO NEXT DOWNSTREAM SECTION).
FLOOD LENGTH	41-50	THE HYDRAULIC LENGTH OF THE MAIN FLOODPLAIN (TO NEXT DOWNSTREAM SECTION).
DAMAGE LENGTH	51-60	THE LENGTH TO BE USED IN COMPUTING TOTAL ACRES FLOODED IN THE REACH.
CHANNEL LENGTH	61-70	THE LENGTH OF CHANNEL IN THE DAMAGE REACH. (SEE TECHNICAL PROCEDURES FOR METHOD OF USE.)
REACH2		USE THIS CARD ONLY IF THE FOLLOWING DATA IS NEEDED. THIS CARD MUST FOLLOW A REACH CARD.
XSEC NAME	11-20	THE NAME OF THE CROSS SECTION TO BE TRANSPOSED FOR THE PRECEDING REACH. THIS SECTION MUST BE IN THE CURRENT DATA. IT MAY NOT BE USED IF A LINK CARD HAS BEEN READ SINCE THE XSEC WAS ENTERED.
DISPLACEMENT	21-30	THE ELEVATION CHANGE TO BE APPLIED TO EACH SURVEYED POINT ON THE CROSS SECTION. USE NEGATIVE VALUE IF SECTION IS TO BE LOWERED, POSITIVE IF IT IS TO BE RAISED.
VELOCITY	31-40	THE VELOCITY AT WHICH SCOUR DAMAGE FIRST OCCURS. THIS IS USED TO COMPUTE ACRES OF SCOUR. (NOT OPERATIONAL AT PRESENT)
SEGMENT		DESCRIBES ELEMENTS OF A SEGMENT OF A CROSS SECTION. EACH SEGMENT CARD MUST BE FOLLOWED BY ITS ASSOCIATED 'NVALUE' CARDS. UP TO 6 SEGMENT CARDS MAY BE ENTERED FOR EACH CROSS SECTION.
XSEC NAME	11-20	THE NAME OF THE CROSS SECTION THAT THIS SEGMENT IS A PORTION OF.
SEGMENT NO	21-30	ANY NUMBER BETWEEN 1 AND 6, A TOTAL OF 6 SEGMENTS MAY BE USED. THEY MUST BE NUMBERED CONSECUTIVELY, BUT NOT NECESSARILY ENTERED CONSECUTIVELY. I.E. IF 4 SEGMENTS ARE USED THEY MAY BE ENTERED 4,2,3,1 BUT NOT BE NUMBERED 4,2,5,1.
SEGMENT TYPE	31-40	THREE SEGMENT TYPE CODES MAY BE USED: C FOR A CHANNEL SEGMENT. THE WIDTH IS USED TO DETERMINE CHANNEL ACRES FLOODED. CHANNEL KD VALUES ARE USED AS COMPUTED. D FOR A DAMAGE SEGMENT. ITS AREA IS INCLUDED IN ACRES FLOODED AND KD VALUES ARE MODIFIED BY THE SQUARE ROOT OF THE MEANDER FACTOR. (SEE TECHNICAL PROCEDURE). N FOR A NON DAMAGE SEGMENT. IT IS NOT TO BE INCLUDED IN DAMAGE ACRES FLOODED BUT THE LENGTH USED IS THE DAMAGE LENGTH. ITS KD VALUES ARE MODIFIED THE SAME AS THE 'D' SEGMENT.
LAST STATION	41-50	THE STATION ON THE CROSS SECTION WHICH MARKS THE END OF THE SEGMENT. THIS MUST BE A SURVEYED POINT. THIS ALSO INDIRECTLY MARKS THE BEGINNING OF THE SEGMENT NUMBER THAT IS 1 HIGHER THAN THIS NUMBER.
LAST ELEVATION	51-60	THE ELEVATION ASSOCIATED WITH THE 'LAST STATION' (OPTIONAL). IF THERE IS ONLY ONE STATION WITH THE 'LAST STATION' VALUE, THE ELEVATION VALUE IS NOT NECESSARY. HOWEVER IF THE SEGMENT ENDS ON A VERTICAL BANK THIS VALUE WILL INDICATE WHETHER THE SEGMENT ENDS AT THE TOP OR BOTTOM OF THE BANK.
NVALUE		ENTERS THE 'n' VALUES AND ASSOCIATED HYDRAULIC RADII. **NOTE THIS CARD MUST ALWAYS FOLLOW THE SEGMENT CARD OR ANOTHER 'n' VALUE CARD.
"n"	11-20,31-40,51-60	THE 'n' VALUES TO BE USED. UP TO 4 'n' VALUES MAY BE USED.
"r"	21-30,41-50,61-70	THE HYDRAULIC RADIUS ('r') ASSOCIATED WITH THE ABOVE 'n' VALUES.
		IF ONLY 1 'n' VALUE IS ENTERED IT IT USED FOR ALL FLOW DEPTHS, IF 2 'n' VALUES AND 1 'r' IS ENTERED ALL FLOWS WITH 'r' LOWER THAN THE 'r' GIVEN USE THE FIRST 'n' VALUE. ALL FLOWS WITH AN 'r' GREATER USE THE 2ND 'n' VALUE. IF 2 OR MORE 'r'S ARE GIVEN THE 'n' VALUE IS INTERPRETED ON A STRAIGHT LINE BASIS FOR ALL VALUES OF 'r' WHICH LIE BETWEEN THE GIVEN ONES. IF THE ACTUAL 'r' IS LESS THAN THE FIRST 'r' GIVEN THE FIRST 'n' VALUE IS USED, IF IT IS GREATER THAN THE LAST 'r' GIVEN THEN THE LAST 'n' VALUE IS USED.
CONTR		GIVES THE NEEDED DATA IF THE BRIDGE IS TO BE COMPUTED BY THE CONTRACTED OPENING METHOD.
COEF OF CONTR	21-30	THE CONTRACTION COEFFICIENT TO USE IN THE CONTRACTION FORMULA.
GIRDER		DESCRIBES THE INDIVIDUAL ITEMS PERTAINING TO AN OPENING (MUST FOLLOW CONTR OR PIER, IF PIER IS NOT USED IT MUST FOLLOW BPR).
ELEV FULL	11-20	THE ELEVATION WHERE ORIFICE FLOW BEGINS. THIS MUST BE BASED ON THE INDIVIDUALS BEST JUDGEMENT BUT USUALLY IS SLIGHTLY ABOVE THE POINT WHERE THE GIRDERS ARE ALL SUBMERGED.
ELEV GRDR BOT	21-30	THE ELEVATION WHERE THE GIRDERS FIRST BEGIN TO REDUCE FLOW AREA FROM THE CHANNEL.
SKEW ANGLE	31-40	THE ANGLE OF THE FLOW IN DEGREES WITH THE PERPENDICULAR TO THE CENTER LINE OF THE ROADWAY.
ORIF COEF	41-50	THE COEFFICIENT TO BE USED IN THE ORIFICE FLOW FORMULA WHEN ORIFICE FLOW CONTROLS.
WEIR COEF	51-60	THE WEIR COEFFICIENT FOR FLOW OVER THE BRIDGE DECK. THIS IS COMPUTED SEPARATE FROM THE FLOW OVER THE ROADWAY PROPER.
DATA CARDS 1-5	11-70 BY 10 COL.	THE X AND Y COORDINATES ARE NEEDED TO DESCRIBE THE SHAPE OF THE BRIDGE GIRDER. THESE POINTS ARE USED TO DEDUCT NET FLOW AREA FROM THE SECTION WHEN FLOW ENCOUNTERS THE GIRDER. THE FIRST AND LAST GIRDER POINTS DEFINE THE WEIR WHEN FLOW OVERTOPS THE GIRDERS. THESE ARE ENTERED X1, Y1, X2, Y2, ETC. THE FIRST AND LAST POINTS MUST COINCIDE WITH POINTS ON THE ROAD CROSS SECTION USE ONLY THE NUMBER OF CARDS ACTUALLY NEEDED.
ENDTABLE		INDICATES THE END OF A GIRDER TABLE.

SCS-ENG-19
REV. DEC. 1974

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

CROSS SECTION DATA

YANTIC RIVER (JOB OR PROJECT) BY S. FOX CHECKED O. LEE DATE 5-9-75

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

Control Word	Data Fields 1	2	3	4	5	6	Card Ident.
	XSEC NAME	HI					
SECTION	93600						
	STATION	ELEV.	STATION	ELEV.	STATION	ELEV.	
	-750.	105.	-720.	100.	-490.	96.	
	-415.	96.	-335.	95.	-165.	87.5	
	-150.	82.	-110.	81.	-82.	81.7	
	-62.	84.	-50.	89.	100.	95.	
	530.	95.	660.	105.			
ENDTABLE							
NOTE:	IF ROD READINGS ARE GIVEN TURN CARDS MAY BE NEEDED						

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SECTION			ENTERS THE DATA FOR A CROSS SECTION OR ROAD.
	NAME	11-20	THE NAME OF THE SECTION OR ROAD (SEE NOTE 1).
	HI	21-30	THE HI IF ROD READINGS ARE GIVEN. CROSS SECTION DATA MAY BE ENTERED IN ANY ORDER AS IT IS SORTED BY THE X DISTANCE AFTER ENTRY. IF 2 POINTS HAVE THE SAME X DISTANCE THEY MUST BY ENTERED IN THE PROPER ORDER AS THESE POINTS WILL NOT BE REVERSED.
	DATA CARDS 1-16	11-70 (BY 10 COL. FIELDS)	THE X AND Y COORDINATES OF THE CROSS SECTION. THESE ARE ENTERED X1, Y1, X2, Y2, ETC. USE ONLY THE NO OF CARDS ACTUALLY NEEDED. ROAD SECTIONS ARE DESCRIBED THE SAME AS VALLEY SECTIONS. WITH BPR AND CONTR BRIDGES THE POINTS WOULD BE ENTERED AS THE SECTION WOULD LOOK WITH THE BRIDGE DECK, AS DEFINED BY THE GRIDER CARDS, REMOVED. WITH CULVERTS THE POINTS ARE ENTERED AS THE ROAD BED ABOVE THE CULVERT.
ENDTABLE			INDICATES THE END OF A SECTION TABLE.

NOTE 1 NAMES MAY CONSIST OF FROM 1 TO 6 ALPHA NUMERIC CHARACTERS. IMBEDDED BLANKS ARE IGNORED SO A HYPHEN (-) SHOULD BE USED TO SEPARATE CHARACTERS IF DESIRED. THE NAME MAY BE ANYWHERE WITHIN THE NAME FIELD.

NOTE 2 IF ROD READINGS ARE USED THE FOLLOWING CARD IS NEEDED:

TURN			INDICATES A TURNING POINT IN THE SURVEY
	BS	11-20	THE BACKSIGHT ON THE TURNING POINT
	FS	21-30	THE FORESIGHT ON THE TURNING POINT

SCS-ENG-20
JAN. 1973

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

WATER SURFACE PROFILE INPUT DATA

YANTIC RIVER (JOB OR PROJECT) BY S. FOX CHECKED O. LEE DATE 5-9-75

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

Control Word	Data Fields 1	2	3	4	5	6	Card Ident.
	FROM XSEC	TO XSEC	STARTING XSEC				
COMPUTE	93600	90863	93600				
TITLE	PROFILE UP TRIB 1						
COMPUTE	T1S1	T1S1	93147				
TITLE							
COMPUTE							
COMPUTE							
LINK							
	FILE NAME	FROM (XSEC)	TO (XSEC)				
CHANGE							
END							
ENDJOB							
ENDRUN							

COMPUTE		THIS SIGNALS COMPUTATIONS TO START.
FROM	11-20	THE FIRST CROSS SECTION NAME IN THE SERIES OF NAMES TO BE USED IN COMPUTATIONS.
TO	21-30	THE LAST CROSS SECTION NAME IN THE SERIES OF NAMES TO BE USED. INTERMEDIATE NAMES WILL BE SELECTED AS THEY APPEAR IN THE REACH FILE.
STARTING XSEC	31-40	THE NAME OF THE CROSS SECTION WHERE STARTING ELEVATIONS ARE TO BE TAKEN. THIS MAY BE THE SAME NAME AS THE FROM FIELD, OR THE CURRENT NAME IN THE STARTS OR STARTE FILE OR A NAME IN THE TRIB FILE. IN THE CASE THAT THIS NAME OCCURS IN BOTH THE START FILE AND TRIB FILE THE START FILE IS USED. IF THE NAME OCCURS IN NEITHER THE START FILE OR TRIB FILE THEN COMPUTATIONS BEGIN AT CRITICAL DEPTH. IF THIS IS LEFT BLANK THE SAME NAME AS IN THE FROM FIELD IS USED.
LINK		IF THE NO. OF SECTIONS IN A WATERSHED IS LARGER THAN THE PROGRAM LIMIT THIS WILL ALLOW THE WATERSHED TO BE DIVIDED INTO SUBAREAS WITH EACH SUBAREA HAVING LESS SECTIONS THAN THE PROGRAM LIMIT. THE SINGLE JUNCTION POINT BETWEEN SUBAREAS IS ALWAYS A CROSS SECTION. THIS JUNCTION SECTION MUST BE LISTED ON THE TRIB CARD. THE COMPUTE CARD WHICH FOLLOWS WOULD NORMALLY BE COMPUTE NAME1 (FIRST REACH IN THE NEW SUBAREA), NAME2, NAME3 (TRIB CARD). SINCE THE LINK CARDS MAKE ALL CROSS SECTION DATA READ BEFORE THAT POINT UNAVAILABLE, SUCH THINGS AS A REACH2 DISPLACEMENT WITH A SECTION DNSTM FROM THE LINK TO UPSTM FROM THE LINK IS IMPOSSIBLE.
CHANGE		USED WHEN UPDATING DATA FILES (SEE SPECIAL SECTION ON UPDATING)
FILE NAME	11-20	THE NAME OF THE FILE TO BE CHANGED. FILES THAT MAY BE CHANGED ARE: REACH (INCLUDES ROAD), SECTION, DISCHARGE, SEGMENT, TRIB, CONTR. BPR, CULV1.
	NOTE:	THE FOLLOWING FROM AND TO FIELDS ARE USED FOR THE 'REACH' FILE ONLY.
FROM (XSEC)	21-30	THE FIRST REACH TO BE CHANGED.
TO (XSEC)	31-40	THE LAST REACH NAME TO BE CHANGED. ALL REACH DATA BETWEEN AND INCLUDING THE FROM AND TO NAMED WILL BE DELETED. IF NEW DATA ARE DESIRED THEY MUST BE ENTERED DIRECTLY AFTER THE CHANGE CARD IN THE ORDER THAT COMPUTATIONS WILL TAKE PLACE. IF THE 'TO' FIELD IS LEFT BLANK THEN ANY NEW REACH (OR ROAD) CARDS THAT FOLLOW WILL BE INSERTED IMMEDIATELY AFTER THE NAME IN THE FROM FIELD. THE DATA ASSOCIATED WITH THE 'FROM' NAME ARE NOT ALTERED. IF DATA FOR ONLY ONE REACH NEEDS TO BE CHANGED THAT NAME WILL APPEAR IN BOTH THE 'FROM' AND 'TO' FIELDS.
END		TO BE USED WHEN THE UPDATES ARE COMPLETED.
ENDJOB		TO BE USED BETWEEN TWO WSP2 JOBS.
ENDRUN		TO BE USED AFTER THE LAST JOB IN THE RUN (CALLS EXIT).

----------80/80 LIST OF INPUT DATA----------

```
WSP2       12
TITLE      YANTIC RIVER   WS-NORWICH, CONN. FHS
TITLE      FLOOD HAZARD   STUDY-FUTURE COND., MARCH 1973
DISCHARGE   96.10     50.       90.       125.      220.      300.
STARTE     93600      90.90     94.15     96.88     101.99    105.45
TRIB       93147
OUTPUT     SPK
REACH      93600      89.90     0.0       0.0       225.
REACH      93350      89.71     250.      250.      175.
REACH2     93147
ROAD       WAWAV      2.7       50.       50.
REACH      93147      89.70     153.      153.      296.
REACH      92397      89.55     750.      750.      756.
REACH      92100      89.47     297.      297.      717.
REACH      90963      89.30     1137.     1137.     825.
ROAD       OLD32      2.7       50.       50.
REACH      90863      89.30     50.       50.       200.
REACH2     90963
REACH      T1S1       6.7       700.      700.      850.
SECTION    93600
           -750.      105.      -720.     100.      -490.     96.
           -415.      96.       -335.     95.       -165.     87.5
           -150.      82.       -110.     81.       -82.      81.7
           -62.       84.       -50.      89.       100.      95.0
            530.      95.       660.      105.
ENDTABLE
SEGMENT    93600      1         D         -165.
NVALUE     0.050
SEGMENT    93600      2         C         -50.
NVALUE     0.040
SEGMENT    93600      3         D         660.
NVALUE     0.050
SECTION    93147
           -400.      100.      -310.     92.4      -274.     92.5
           -257.      91.       -215.     89.9      -197.     87.8
           -194.      82.5      -177.     81.8      -155.     81.6
           -128.      82.5      -107.     84.7      -100.     90.8
           -92.       90.8      -85.      87.5      -72.      86.8
           -42.       87.0      -24.      88.2      -10.      88.7
             0.       90.3      83.       90.0      90.       90.9
            263.      92.3      370.      97.3      465.      108.3
            465.      115.
ENDTABLE
SEGMENT    93147      1         D         -197.
NVALUE     0.065
```

----------80/80 LIST OF INPUT DATA----------

```
SEGMENT   93147     2         C         -100.     90.8
NVALUE    0.040
SEGMENT   93147     3         D         465.      115.
NVALUE    0.060
SECTION   WAWAV
          -1685.    107.3     -1685.    101.3     -1365.    100.2
          -1240.    99.0      -1240.    107.0     -1180.    107.0
          -1180.    99.0      -1060.    96.6      -970.     96.5
          -970.     107.      -900.     107.      -900.     96.5
          -860.     96.2      -860.     107.      -835.     107.
          -835.     96.0      -780.     97.       -780.     107.
          -745.     107.      -745.     97.5      -422.     93.2
          -422.     107.      -360.     107.      -360.     92.6
          -282.     92.       -117.     96.7      -112.     94.2
          -72.      81.5      -52.      81.7      -10.      84.0
          -5.       87.5      -5.       97.3      60.       95.0
           130.     95.0      160.      98.5      175.      115.0
ENDTABLE
----------MAX ELEV DIFFERENCE BETWEEN POINTS EXCEEDS  12. FEET----------
BPR       WAWAV     A         3.        6.
PIER      81.5      1.5
GIRDER      92.5    91.7      0.        0.8       2.7
          -117.     96.7      -113.     91.7      -5.       92.4
          -5.       97.3
ENDTABLE
SECTION   92397
          -296.     95.2      -274.     85.3      -269.     84.2
          -241.     83.7      -218.     84.2      -214.     85.5
          -205.     89.1      -160.     89.2      -94.      90.3
          -53.      95.0      103.      99.0      118.      99.5
           213.     99.2
ENDTABLE
SEGMENT   92397     1         C         -205.
NVALUE    0.040
SEGMENT   92397     2         D         213.
NVALUE    0.045
SECTION   92100
          -260.     115.0     -260.     98.4      -218.     97.8
          -213.     9 6.0     -198.     94.6      -48.      95.2
          -48.      99.5      -40.      99.5      -40.      101.3
          -7.       101.3     12.       101.0     25.       101.6
           40.      109.0
ENDTABLE
----------MAX ELEV DIFFERENCE BETWEEN POINTS EXCEEDS  12. FEET----------
SEGMENT   92100     1         D         -218.
NVALUE    0.045
SEGMENT   92100     2         C         -48.
```

```
----------80/80 LIST OF INPUT DATA----------
NVALUE    0.015
SEGMENT   92100     3         D         40.
NVALUE    0.045
SECTION   90963
          -475.     103.      -460.     101.9     -420.     102.4
          -380.     98.4      -250.     97.4      -110.     97.4
           0.       97.8      8.        94.2      -25.      85.5
           60.      85.5      100.      85.5      100.      96.5
           142.     110.      -600.     110.
ENDTABLE
----------DATA POINTS REORDERED BY PROGRAM ACCORDING TO X VALUES
          DUPLICATE X POINTS NOT CHANGED----------
----------MAX ELEV DIFFERENCE BETWEEN POINTS EXCEEDS  12. FEET----------
SEGMENT   90963     1         D         0.
NVALUE    0.055
SEGMENT   90963     2         C         100.      96.5
NVALUE    0.040
SEGMENT   90963     3         D         142.
NVALUE    0.055
SECTION   OLD32
          -226.     117.1     -217.     112.3     -190.     111.2
          -100.     110.5     -94.      92.7      -78.      88.5
          -60.      98.       -17.      109.2     25.       108.8
          25.       125.
ENDTABLE
----------MAX ELEV DIFFERENCE BETWEEN POINTS EXCEEDS  12. FEET----------
CULV1     OLD32     2.        41111
CULV2     12.       16.       150.      87.       86.5
CULV1     OLD32     1.        12311
CULV2     6.                  150.      89.3      89.0
SECTION   T1S1
          -96.      95.2      -74.      85.3      -69.      84.2
          -47.      83.7      -25.      84.2      -14.      85.5
          -5.       89.1      40.       89.2      106.      90.3
          147.      95.0      303.      99.0      318.      99.5
          413.      99.2
ENDTABLE
SEGMENT   T1S1      1         C         -5
NVALUE    0.040
SEGMENT   T1S1      2         D         413
NVALUE    0.045
COMPUTE   93600     90863     93600
----------END OF 80/80 LIST----------
```

COMPUTE 93600 90863 93600

----------STARTING DATA FROM GIVEN ELEVATION----------

RATING TABLE FOR SECTION 93600 DA= 89.9

NO.	ELEV	AREA	CFS	ACRES FLOODED DAMAGE	ACRES FLOODED CHANNEL	ACRES FLOODED NON-DAM	CSM	CRIT ELEV	FRICTION SLOPE
0	81.0	0.0	0.0						
BANK FULL	87.5	561.9	3038.6	0.0	0.0	0.0			
ZERO DAMG	87.5	561.9	3038.6	0.0	0.0	0.0			
1	90.9	1127.7	4628.0	1.24	0.0	0.0	50.00	86.1	0.00096
2	94.1	2157.3	8330.4	2.04	0.0	0.0	90.00	88.3	0.00077
3	96.9	4365.3	11570.0	5.66	0.0	0.0	125.00	90.0	0.00051
4	102.0	10770.5	20363.2	6.99	0.0	0.0	220.00	92.6	0.00018
5	105.4	15556.1	27768.0	7.33	0.0	0.0	300.00	94.0	0.00012

**********PROFILE NO 5 EXCEEDS SURVEY DATA**********

SEGMENT TABLE FOR SECTION 93600

CSM		TOTAL	SEG NO 1 D	SEG NO 2 C	SEG NO 3 D
1	DISCHARGE CFS	4628.	174.	4412.	42.
51.	VELOCITY FPS	4.55	1.32	4.65	0.91
2	DISCHARGE CFS	8330.	925.	6889.	517.
93.	VELOCITY FPS	4.79	1.84	5.21	1.56
3	DISCHARGE CFS	11570.	1652.	7916.	2001.
129.	VELOCITY FPS	4.11	1.42	4.84	1.28
4	DISCHARGE CFS	20363.	5232.	7936.	7195.
227.	VELOCITY FPS	2.50	1.41	3.57	1.49
5	DISCHARGE CFS	27768.	8422.	8454.	10892.
309.	VELOCITY FPS	2.16	1.47	3.22	1.51
1	ELEV 90.9 KD	149145.	5498.	142402.	1245.
2	ELEV 94.1 KD	299286.	33142.	247676.	18468.
3	ELEV 96.9 KD	511077.	72242.	353180.	85655.
4	ELEV 102.0 KD	1510900.	388155.	588966.	533779.
5	ELEV 105.4 KD	2560122.	779209.	774923.	1005990.

KD TABLE FOR CROSS SECTION 93600

ELEVATION	AREA	KD	KD BY SEGMENT		
81.00	0.				
82.	39.	970.	1.	968.	1.
83.	115.	5335.	1.	5333.	1.
84.	203.	12573.	1.	12571.	1.
85.	299.	23082.	1.	23080.	1.
86.	400.	36225.	1.	36223.	1.
87.	507.	51869.	1.	51867.	1.
88.	621.	70565.	29.	70505.	1.
89.	756.	92726.	625.	92100.	1.
90.	929.	120176.	2441.	117501.	234.
91.	1150.	152792.	5989.	145318.	1485.
92.	1418.	191537.	11707.	175451.	4379.
93.	1734.	237239.	19993.	207813.	9433.
94.	2102.	290805.	31107.	242288.	16976.
95.	2633.	343807.	43463.	278878.	21295.
96.	3457.	419382.	56168.	317518.	40914.
97.	4499.	528991.	76017.	358149.	91828.
98.	5635.	672240.	113541.	400716.	156488.
99.	6845.	839821.	160147.	445157.	232731.
100.	8128.	1034975.	220441.	491424.	320456.
101.	9444.	1259230.	296314.	539545.	421621.
102.	10784.	1513685.	389188.	589475.	535021.
103.	12150.	1786127.	488009.	641073.	655680.
104.	13534.	2081672.	597509.	694417.	788296.
105.	14928.	2402482.	718816.	749521.	934147.
106.	16323.	2756553.	858250.	806480.	1099337.
107.	17718.	3145796.	1017629.	865277.	1285502.
108.	19113.	3572140.	1198869.	925898.	1494339.

CROSS SECTION 93600

SCALES ARE 1 INCH = 5000. CFS, AND 4.8 FEET/ ELEVATION

RATING TABLE FOR SECTION 93350 DA= 89.7

NO.	ELEV	AREA	CFS	ACRES FLOODED DAMAGE	ACRES FLOODED CHANNEL	ACRES FLOODED NON-DAM	CSM	CRIT ELEV	FRICTION SLOPE
0	81.6	0.0	0.0						
ZERO DAMG	86.8	400.0	2512.4	0.0	0.0	0.0			
BANK FULL	87.8	528.9	2995.6	1.01	0.0	0.0			
1	91.2	1306.7	4622.5	1.56	0.0	0.0	50.00	87.2	0.00115
2	94.4	3105.1	8320.4	2.58	0.0	0.0	90.00	89.0	0.00067
3	97.1	4916.8	11556.2	2.94	0.0	0.0	125.00	90.6	0.00042
4	102.0	8764.9	20338.9	3.26	0.0	0.0	220.00	92.5	0.00027
5	105.4	11592.8	27734.8	3.38	0.0	0.0	300.00	93.4	0.00022

**********PROFILE NO 4 EXCEEDS SURVEY DATA**********
**********PROFILE NO 5 EXCEEDS SURVEY DATA**********

SEGMENT TABLE FOR SECTION 93350

CSM		TOTAL	SEG NO 1 D	2 C	3 D
1	DISCHARGE CFS	4622.	70.	4028.	525.
52.	VELOCITY FPS	4.69	0.94	4.98	1.24
2	DISCHARGE CFS	8320.	509.	5339.	2472.
93.	VELOCITY FPS	3.94	1.24	4.74	1.58
3	DISCHARGE CFS	11556.	1092.	5974.	4491.
129.	VELOCITY FPS	3.31	1.34	4.32	1.65
4	DISCHARGE CFS	20339.	2782.	7834.	9723.
227.	VELOCITY FPS	2.99	1.58	4.21	1.89
5	DISCHARGE CFS	27735.	4344.	9364.	14027.
309.	VELOCITY FPS	2.95	1.77	4.27	2.02
1	ELEV 91.2 KD	135933.	1783.	119169.	14981.
2	ELEV 94.4 KD	319581.	19072.	206649.	93861.
3	ELEV 97.1 KD	562008.	52935.	290968.	218105.
4	ELEV 102.0 KD	1238062.	168805.	477922.	591336.
5	ELEV 105.4 KD	1860590.	291205.	628576.	940809.

COEFK	AKB	DLTAK	SIGMA	DKE	DKS	M	ALPHA	ALPHA2	BRIDA	APPAR	AEXIT
0.2269	0.2014	0.0255	0.9721	0.0	0.0	0.8679	1.8823	1.7658	721.5840	1496.7996	1369.6033

DCRIT 87.66 KBCRIT=

ELEVB= 91.54 EWSBD= 91.24 HDLOSS= 0.30

0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8823	1.7658	771.1992	1496.7996	1369.6033

DCRIT -1.00 KBCRIT=

ELEVB= 95.54 EWSBD= 94.48 HDLOSS= 1.06

0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8823	1.7658	771.1992	1496.7996	1369.6033

DCRIT -1.00 KBCRIT=

ELEVB= 97.60 EWSBD= 97.10 HDLOSS= 0.50

0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8823	1.7658	771.1992	1496.7996	1369.6033

DCRIT -1.00 KBCRIT=

ELEVB= 102.41 EWSBD= 102.03 HDLOSS= 0.38

0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8823	1.7658	771.1992	1496.7996	1369.6033

DCRIT -1.00 KBCRIT=

ELEVB= 105.84 EWSBD= 105.46 HDLOSS= 0.38

ROAD SECTION WAWAV

NO.	HW	CFS	HL	TW	CSM
0	81.50	0.00	0.00	0.00	0.00
1	91.54	4622.18	0.30	91.24	50.00
2	95.54	8319.91	1.06	94.48	90.00
3	97.60	11555.44	0.50	97.10	125.00
4	102.41	20337.57	0.38	102.03	220.00
5	105.84	27733.04	0.38	105.46	300.00

MIN ROAD ELEVATION 92.00

BRIDGE TYPE 2 GIRDER BOTTOM ELEVATION = 91.70 OPENING NO.= 1

RATING TABLE FOR SECTION 93147 DA= 89.7

NO.	ELEV	AREA	CFS	ACRES FLOODED DAMAGE	ACRES FLOODED CHANNEL	ACRES FLOODED NON-DAM	CSM	CRIT ELEV	FRICTION SLOPE
0	81.6	0.0	0.0						
ZERO DAMG	86.8	400.0	2386.1	0.0	0.0	0.0			
BANK FULL	87.8	528.9	2845.0	1.88	0.0	0.0			
1	91.7	1505.7	4622.2	3.06	0.0	0.0	50.00	87.2	0.00089
2	95.6	3872.5	8319.9	4.63	0.0	0.0	90.00	89.0	0.00040
3	97.7	5342.4	11555.4	5.06	0.0	0.0	125.00	90.6	0.00034
4	102.4	9113.4	20337.6	5.53	0.0	0.0	220.00	92.5	0.00024
5	105.9	11948.9	27733.0	5.73	0.0	0.0	300.00	93.4	0.00020

**********PROFILE NO 4 EXCEEDS SURVEY DATA**********
**********PROFILE NO 5 EXCEEDS SURVEY DATA**********

SEGMENT TABLE FOR SECTION 93147

CSM		TOTAL	1	SEG ND 2	3
			D	C	D
1	DISCHARGE CFS	4622.	94.	3912.	617.
52.	VELOCITY FPS	4.23	0.89	4.56	1.14
2	DISCHARGE CFS	8320.	645.	4811.	2863.
93.	VELOCITY FPS	3.10	1.12	3.89	1.39
3	DISCHARGE CFS	11555.	1157.	5721.	4677.
129.	VELOCITY FPS	3.01	1.27	3.98	1.56
4	DISCHARGE CFS	20338.	2844.	7688.	9805.
227.	VELOCITY FPS	2.85	1.54	4.04	1.83
5	DISCHARGE CFS	27733.	4393.	9237.	14102.
309.	VELOCITY FPS	2.86	1.73	4.13	1.97
1	ELEV 91.7 KD	154938.	3118.	131389.	20432.
2	ELEV 95.6 KD	416542.	31886.	242198.	142458.
3	ELEV 97.7 KD	625383.	62315.	310771.	252298.
4	ELEV 102.4 KD	1310772.	183061.	495949.	631762.
5	ELEV 105.9 KD	1944681.	307845.	648262.	988575.

RATING TABLE FOR SECTION 92397 DA= 89.5

NO.	ELEV	AREA	CFS	ACRES FLOODED DAMAGE	ACRES FLOODED CHANNEL	ACRES FLOODED NON-DAM	CSM	CRIT ELEV	FRICTION SLOPE
0	83.7	0.0	0.0						
BANK FULL	89.1	339.2	2748.1	0.0	0.0	0.0			
ZERO DAMG	89.1	339.2	2748.1	0.0	0.0	0.0			
1	92.8	1022.9	4617.8	3.79	0.0	0.0	50.00	90.2	0.00164
2	96.2	1867.2	8312.1	5.04	0.0	0.0	90.00	91.5	0.00115
3	98.2	2510.7	11544.5	6.41	0.0	0.0	125.00	92.5	0.00111
4	102.8	4306.5	20318.4	11.48	0.0	0.0	220.00	94.7	0.00100
5	106.1	5596.0	27706.9	15.11	0.0	0.0	300.00	96.4	0.00092

**********PROFILE NO 2 EXCEEDS SURVEY DATA**********
**********PROFILE NO 3 EXCEEDS SURVEY DATA**********
**********PROFILE NO 4 EXCEEDS SURVEY DATA**********
**********PROFILE NO 5 EXCEEDS SURVEY DATA**********

SEGMENT TABLE FOR SECTION 92397

CSM		TOTAL	SEG NO 1 C	SEG NO 2 D
1	DISCHARGE CFS	4618.	3547.	1071.
52.	VELOCITY FPS	5.09	5.60	2.75
2	DISCHARGE CFS	8312.	5437.	2875.
93.	VELOCITY FPS	5.03	5.78	3.10
3	DISCHARGE CFS	11545.	7074.	4470.
129.	VELOCITY FPS	5.34	6.32	3.21
4	DISCHARGE CFS	20318.	11506.	8812.
227.	VELOCITY FPS	5.76	7.47	3.19
5	DISCHARGE CFS	27707.	15283.	12424.
309.	VELOCITY FPS	5.92	8.29	3.31
1	ELEV 92.8 KD	113840.	87558.	26282.
2	ELEV 96.2 KD	245496.	160806.	84689.
3	ELEV 98.2 KD	346378.	212324.	134053.
4	ELEV 102.8 KD	645233.	354433.	290800.
5	ELEV 106.1 KD	931754.	476678.	455077.

RATING TABLE FOR SECTION 92100 DA= 89.5

NO.	ELEV	AREA	CFS	ACRES FLOODED DAMAGE	ACRES FLOODED CHANNEL	ACRES FLOODED NON-DAM	CSM		CRIT ELEV	FRICTION SLOPE
0	94.6	0.0	0.0							
BANK FULL	95.2	46.9	842.2	0.0	0.0	0.0				
ZERO DAMG	95.2	46.9	842.2	0.0	0.0	0.0				
1	97.9	494.7	4615.5	3.01	0.0	0.0	50.00	C	97.9	0.00218
2	99.2	767.7	8307.9	3.49	0.0	0.0	90.00	C	99.2	0.00195
3	100.2	967.9	11538.7	3.61	0.0	0.0	125.00	C	100.2	0.00192
4	102.5	1569.9	20308.1	4.72	0.0	0.0	220.00		102.4	0.00162
5	103.8	1931.0	27692.9	4.76	0.0	0.0	300.00		103.7	0.00175

SEGMENT TABLE FOR SECTION 92100

CSM		TOTAL	SEG NO 1 D	SEG NO 2 C	SEG NO 3 D
1	DISCHARGE CFS	4615.	1.	4614.	0.
52.	VELOCITY FPS	9.40	0.53	9.38	0.0
2	DISCHARGE CFS	8308.	76.	8232.	0.
93.	VELOCITY FPS	11.40	1.61	11.43	0.0
3	DISCHARGE CFS	11539.	196.	11338.	4.
129.	VELOCITY FPS	12.84	2.28	12.94	0.82
4	DISCHARGE CFS	20308.	622.	19513.	172.
227.	VELOCITY FPS	14.99	3.36	15.27	1.62
5	DISCHARGE CFS	27693.	964.	26224.	505.
310.	VELOCITY FPS	17.15	4.05	17.59	2.50
1	ELEV 97.9 KD	98905.	8.	98896.	1.
2	ELEV 99.2 KD	188181.	1606.	186573.	1.
3	ELEV 100.2 KD	263413.	4438.	258894.	81.
4	ELEV 102.5 KD	504964.	15450.	485423.	4092.
5	ELEV 103.8 KD	662572.	23025.	627690.	11857.

RATING TABLE FOR SECTION 90963 DA= 89.3

NO.	ELEV	AREA	CFS	ACRES FLOODED DAMAGE	ACRES FLOODED CHANNEL	ACRES FLOODED NON-DAM	CSM	CRIT ELEV	FRICTION SLOPE
0	85.5	0.0	0.0						
ZERO DAMG	85.5	0.0	0.0	0.0	0.0	0.0			
BANK FULL	96.5	1346.8	3621.6	7.44	0.0	0.0			
1	99.5	2496.3	4610.5	9.48	0.0	0.0	50.00	90.8	0.00029
2	101.5	3550.2	8298.9	10.25	0.0	0.0	90.00	92.7	0.00038
3	103.0	4391.3	11526.3	11.23	0.0	0.0	125.00	94.0	0.00043
4	106.3	6455.6	20286.3	12.59	0.0	0.0	220.00	97.9	0.00047
5	108.6	8050.2	27663.1	13.51	0.0	0.0	300.00	99.0	0.00048

SEGMENT TABLE FOR SECTION 90963

CSM		TOTAL	SEG NO 1 D	2 C	3 D
1	DISCHARGE CFS	4611.	1488.	3114.	9.
52.	VELOCITY FPS	2.44	1.07	2.86	0.60
2	DISCHARGE CFS	8299.	3483.	4777.	39.
93.	VELOCITY FPS	2.99	1.57	3.69	0.96
3	DISCHARGE CFS	11526.	5359.	6087.	81.
129.	VELOCITY FPS	3.34	1.86	4.22	1.21
4	DISCHARGE CFS	20286.	11041.	8998.	247.
227.	VELOCITY FPS	3.84	2.44	5.08	1.65
5	DISCHARGE CFS	27663.	16083.	11140.	440.
310.	VELOCITY FPS	4.13	2.76	5.56	1.92
1	ELEV 99.5 KD	270230.	85635.	184134.	462.
2	ELEV 101.5 KD	424925.	177713.	245311.	1901.
3	ELEV 103.0 KD	554287.	256418.	294076.	3793.
4	ELEV 106.3 KD	931741.	506674.	413762.	11304.
5	ELEV 108.6 KD	1257249.	729967.	507449.	19835.

ROAD SECTION OLD32

NO.	HW	CFS	HL	TW	CSM
0	87.00	0.00	0.00	0.00	0.00
1	100.60	4610.52	1.12	99.48	50.00
2	104.00	8298.93	2.48	101.52	90.00
3	106.61	11526.29	3.60	103.01	125.00
4	111.65	20286.27	5.36	106.29	220.00
5	114.12	27663.09	5.52	108.60	300.00

MIN ROAD ELEVATION 88.50

OPENING NO.	NO. CULVERTS	CULV. CODE	HEIGHT OR DIAM	WIDTH	LENGTH	U/S INVERT	D/S INVERT	(N) COEFF
1	2	41111.	12.00	16.00	150.00	87.00	86.50	0.012
2	1	12311.	6.00		150.00	89.30	89.00	0.024

RATING TABLE FOR SECTION 90863 OA= 89.3

NO.	ELEV	AREA	CFS	ACRES FLOODED OAMAGE	ACRES FLOODED CHANNEL	ACRES FLOODED NON-OAM	CSM	CRIT ELEV	FRICTION SLOPE
0	85.5	0.0	0.0						
ZERO OAMG	85.5	0.0	0.0	0.0	0.0	0.0			
BANK FULL	96.5	1346.8	3345.5	1.72	0.0	0.0			
1	100.7	3083.5	4610.5	2.37	0.0	0.0	50.00	90.8	0.00017
2	104.0	5002.5	8298.9	2.83	0.0	0.0	90.00	92.7	0.00016
3	106.6	6674.4	11526.3	3.08	0.0	0.0	125.00	94.0	0.00014
4	111.7	10233.2	20286.3	3.57	0.0	0.0	220.00	97.9	0.00013
5	114.2	12001.7	27663.1	3.81	0.0	0.0	300.00	99.0	0.00015

**********PROFILE NO 4 EXCEEDS SURVEY DATA**********
**********PROFILE NO 5 EXCEEDS SURVEY DATA**********

SEGMENT TABLE FOR SECTION 90863

CSM		TOTAL	SEG NO 1 O	SEG NO 2 C	SEG NO 3 O
1	DISCHARGE CFS	4611.	1783.	2812.	15.
52.	VELOCITY FPS	1.93	0.96	2.33	0.56
2	DISCHARGE CFS	8299.	4096.	4131.	71.
93.	VELOCITY FPS	2.08	1.22	2.67	0.80
3	DISCHARGE CFS	11526.	6342.	5038.	147.
129.	VELOCITY FPS	2.10	1.35	2.79	0.91
4	DISCHARGE CFS	20286.	12412.	7480.	394.
227.	VELOCITY FPS	2.31	1.64	3.24	1.14
5	DISCHARGE CFS	27663.	17334.	9744.	585.
310.	VELOCITY FPS	2.57	1.92	3.81	1.33
1	ELEV 100.7 KD	355024.	136061.	217839.	1124.
2	ELEV 104.0 KO	659395.	324612.	329193.	5590.
3	ELEV 106.6 KO	975216.	536237.	426631.	12348.
4	ELEV 111.7 KD	1785613.	1104087.	644291.	37236.
5	ELEV 114.2 KO	2317699.	1492201.	766600.	58898.

----------80/80 LIST OF INPUT DATA----------

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TITLE     PROFILE UP TRIB 1
COMPUTE   T1S1      T1S1      93147
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----------END OF 80/80 LIST----------

COMPUTE T1S1 T1S1 93147

----------STARTING DATA FROM PREVIOUS COMPUTATIONS----------

RATING TABLE FOR SECTION T1S1 DA= 6.7

NO.	ELEV	AREA	CFS	ACRES FLOODED DAMAGE	ACRES FLOODED CHANNEL	ACRES FLOODED NON-DAM	CSM	CRIT ELEV	FRICTION SLOPE
0	83.7	0.0	0.0						
BANK FULL	89.1	332.9	556.6	0.0	0.0	0.0			
ZERO DAMG	89.1	332.9	556.6	0.0	0.0	0.0			
1	92.0	850.9	855.1	4.09	0.0	0.0	50.00	86.0	0.00009
2	95.8	1726.2	1539.2	5.32	0.0	0.0	90.00	86.9	0.00005
3	97.8	2369.4	2137.8	6.88	0.0	0.0	125.00	87.6	0.00004
4	102.6	4209.1	3762.5	12.62	0.0	0.0	220.00	89.7	0.00004
5	106.0	5535.1	5130.7	16.82	0.0	0.0	300.00	90.4	0.00003

**********PROFILE NO 2 EXCEEDS SURVEY DATA**********
**********PROFILE NO 3 EXCEEDS SURVEY DATA**********
**********PROFILE NO 4 EXCEEDS SURVEY DATA**********
**********PROFILE NO 5 EXCEEDS SURVEY DATA**********

SEGMENT TABLE FOR SECTION T1S1

CSM		TOTAL	SEG NO 1 C	SEG NO 2 D
1	DISCHARGE CFS	855.	694.	161.
128.	VELOCITY FPS	1.15	1.24	0.56
2	DISCHARGE CFS	1539.	1017.	522.
230.	VELOCITY FPS	1.00	1.14	0.63
3	DISCHARGE CFS	2138.	1322.	816.
319.	VELOCITY FPS	1.04	1.23	0.63
4	DISCHARGE CFS	3763.	2130.	1632.
562.	VELOCITY FPS	1.09	1.41	0.61
5	DISCHARGE CFS	5131.	2826.	2305.
766.	VELOCITY FPS	1.11	1.55	0.62
1	ELEV 92.0 KD	88960.	72649.	16312.
2	ELEV 95.8 KD	223989.	148021.	75968.
3	ELEV 97.8 KD	323161.	200104.	123057.
4	ELEV 102.6 KD	625360.	344435.	280926.
5	ELEV 106.0 KD	916433.	469281.	447151.

----------80/80 LIST OF INPUT DATA----------
ENDJOB

**********NORMAL END OF JOB----------

Blank Input Forms

This section contains a set of blank input forms. Input forms can be obtained through USDA Central Supply.

SCS-ENG-16
REV. DEC. 1974

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

WATER SURFACE PROFILE INPUT DATA

_____ (JOB OR PROJECT) BY _____ CHECKED _____ DATE _____

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

Control Word	Data Fields						Card Ident.
	1	2	3	4	5	6	
	DELTA ELEV.						
WSP2							
	ANY ALPHAMERIC TITLE WILL BE PRINTED AT TOP OF EACH PAGE MAY NOT BE CHANGED IN JOB						
TITLE							
	ANY ALPHAMERIC TITLE WILL BE PRINTED AT TOP OF EACH PAGE MAY BE CHANGED AT ANY TIME						
TITLE							
	TOTAL D. A.	CSM	CSM	CSM	CSM	CSM	
DISCHARGE							
DISCHARGE							
DISCHARGE							
	XSEC NAME	SLOPE	SLOPE	SLOPE	SLOPE	SLOPE	
STARTS							
STARTS							
STARTS							
	XSEC NAME	ELEVATION	ELEVATION	ELEVATION	ELEVATION	ELEVATION	
STARTE							
STARTE							
STARTE							
	XSEC NAME	XSEC NAME	XSEC NAME	XSEC NAME	XSEC NAME	XSEC NAME	
TRIB							
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TRIB							
TRIB							
	OUTPUT OPTIONS						
OUTPUT							
	ANY ALPHAMERIC MESSAGE						
COMMENT							
	SAME AS COMMENT						
*							

PAGE _____ OF _____

WSP2			RESETS ALL PROGRAM VARIABLES TO PROGRAM DEFINED VALUES FOR BEGINNING OF A NEW JOB. THIS MUST BE THE FIRST CARD OF A JOB.
	DELTA ELEV	11-20	MAXIMUM ELEVATION DIFFERENCE BETWEEN X-SECTION COORDINATES WITHOUT A CAUTION STATEMENT RESULTING IN PRINTOUT. DEFAULT IS 20 FEET.
TITLE		11-70	ANY ALPHAMERIC DATA. THE FIRST TITLE ENTERED WILL BE RETAINED FOR THE ENTIRE JOB, AND WILL BE PRINTED AT THE TOP OF EACH PAGE. IT MAY NOT BE ALTERED. THE SECOND TITLE ENTERED WILL ALSO BE PRINTED AT THE OF EACH PAGE. IT MAY BE ALTERED AT ANY TIME.
DISCHARGE			ENTERS BASIC CSM VALUES TO BE USED.
	BASIC DRAINAGE AREA	11-20	THE DRAINAGE AREA AT THE LOWER END OF THE WATERSHED. (SEE NOTE).
	CSM	21-30 31-40 41-50 51-60 61-70	THE CSM VALUES FOR EACH PROFILE DESIRED. THESE VALUES SET THE ORDER OF COMPUTATIONS. I.E. THE FIRST CSM VALUE ENTERED IS THE FIRST PROFILE RUN. UP TO 3 CARDS MAY BE USED.
STARTS			SAME AS STARTE EXCEPT THAT SLOPES IN FT/FT ARE ENTERED INSTEAD OF ELEVATIONS.
STARTE			USED TO ENTER THE STARTING ELEVATIONS FOR EACH PROFILE TO BE RUN. UP TO 3 CARDS PER SECTION MAY BE USED BUT ONLY ONE SECTION MAY BE ENTERED AT ONE TIME.
	XSEC NAME	11-20	THE NAME OF THE CROSS SECTION FOR WHICH THE STARTING ELEVATIONS APPLY. THE NAME MUST BE ENTERED IN EACH CARD USED.
	ELEVATION	21-70 BY 10 COL. FIELDS	THE STARTING ELEVATION FOR EACH CSM. THE FIRST ELEVATION ENTERED REFERS TO THE FIRST CSM ETC.
TRIB		11-70 BY 10 COL. FIELDS	THE NAMES OF CROSS SECTIONS WHERE DATA ARE TO BE HELD FOR USE AS STARTING DATA ON LATER PROFILES. THESE NAMES CANNOT BE ROAD NAMES. UP TO 20 NAMES MAY BE USED.
OUTPUT			THIS CARD SETS THE OUTPUT SWITCHES FOR THE TYPE OF OUTPUT DESIRED. EACH TIME AN OUTPUT CARD IS ENTERED ALL PREVIOUS OUTPUT OPTIONS ARE TURNED OFF. THE PRINTED VALLEY SECTION AND BRIDGE RATING TABLES ARE STANDARD OUTPUT.
	OUTPUT OPTIONS	11-20	R - PUNCH RATING TABLE FOR INPUT TO HYDROLOGY PROGRAM. P - PLOT RATING TABLES S - PRINT SEGMENT TABLE K - KD TABLE NOTE THESE OPTIONS MAY BE ENTERED IN <u>ANY</u> ORDER.
COMMENT	OR *		PROVIDES AN 80-80 LIST OF DESIRED COMMENTS ON THE OUTPUT LISTING OF INPUT DATA. DO NOT USE WITHIN GROUPS OF CARDS THAT GO TOGETHER SUCH AS SEGMENT AND NVALUE.
		11-70	THE DESIRED TEXT.

NOTE: AN OPTION HAS BEEN ADDED SO THAT A GIVEN PROFILE IN CFS CAN BE RUN. TO DO THIS INPUT A NEGATIVE VALUE FOR BASIC DRAINAGE AREA. ENTER THE CFS VALUE FOR EACH REACH IN PLACE OF THE DRAINAGE AREA ON THE REACH CARD. THEN PUT A VALUE OF 1.0 FOR THE FIRST CSM VALUE. IF PROFILES WITH CFS VALUES RATIOED UP OR DOWN FROM THE GIVEN VALUES AT EACH SECTION ARE DESIRED, THESE RATIOS CAN BE LISTED IN PLACE OF CSM VALUES.

NOTE: NAMES MAY CONSIST OF FROM 1 to 6 ALPHA NUMERIC CHARACTERS. IMBEDDED BLANKS ARE IGNORED SO A - SHOULD BE USED TO SEPARATE CHARACTERS IF DESIRED. THE NAME MAY BE ANYWHERE WITHIN THE NAME FIELD.

SCS-ENG-17
REV. MAR. 1976

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

WATER SURFACE PROFILE INPUT DATA

_____ BY _____ CHECKED _____ DATE _____
(JOB OR PROJECT)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

Control Word	Data Fields						Card Ident.
	1	2	3	4	5	6	
	ROAD NAME	WEIR COEF	CHANNEL LENGTH	FLOOD LENGTH			
ROAD							
	ROAD NAME	SKEW TYPE	BASE CURVE	PIER CURVE			
BPR							
	BOTTOM ELEV	AVG WIDTH	BOTTOM ELEV	AVG WIDTH	BOTTOM ELEV	AVG WIDTH	
PIER							
	ELEV FULL	ELEV GRDR BOT	SKEW ANGLE	ORIF COEF	WEIR COEF		
GIRDER							
ENDTABLE							
	ROAD NAME	NO. OF PIPES	CULV CODE				
CULV 1							
	DIA OR HEIGHT	WIDTH	LENGTH	ELEV US INVERT	ELEV DS INVERT	CULV 'n'	
CULV 2							
CULV 1							
CULV 2							
CULV 1							
CULV 2							
CULV 1							
CULV 2							
CULV 1							
CULV 2							

PAGE _____ OF _____

ROAD			ENTERS THE ELEMENTS FOR A ROAD SECTION.
	ROAD NAME	11-20	THE NAME OF THE ROAD, EACH MUST BE UNIQUE. (SEE NOTE 1, SCS-ENC-19).
	WEIR COEF	21-30	THE COEFFICIENT TO BE USED FOR FLOW OVER THE ROADWAY (USUALLY 2.7).
	REACH LENCTHS	31-50	SEE CHANNEL AND FLOOD LENCTH DESCRIPTIONS ON THE REACH CARD. (SCS-ENC-18)
BPR			ENTERS DATA TO BE USED FOR COMPUTINC BPR BRIDCES
	ROAD NAME	11-20	THE NAME OF THE ROAD THAT THIS BRIDCE IS IN. (SEE NOTE 1, SCS-ENG-19)
	SKEW TYPE	21-30	A OR B ACCORDINC TO FICURE 10 IN "BPR HYDRAULICS OF BRIDCE WATERWAYS, 1970".
	BASE CURVE	31-40	REFERENCE FICURE 6 "BPR HYDRAULICS OF BRIDCE WATERWAYS, 1970", CURVES ARE NUMBERED 1-3 FROM BOTTOM TO TOP ON FICURE 6.
	PIER CURVE	41-50	REFERENCE ABOVE BPR MANUAL FICURE 7. CURVES ARE NUMBERED 1-8 FROM LEFT TO RIGHT.
PIER			DEFINES THE PIER SIZES IF PRESENT. (THIS CARD MUST FOLLOW THE BPR CARD IF USED). MAX OF 3 PIERS (1 CARD) MAY BE ENTERED. (IF MORE ARE PRESENT COMBINE DIMENSIONS).
	BOTTOM ELEV.	11-20,31-40,51-60	THE ELEVATIONS WHERE THE PIERS INTERSECT THE CHANNEL BOTTOM.
	AVC WIDTH	21-30,41-50,61-70	THE AVERACE WIDTHS OF THE PIERS (SEE FICURE 7 BPR MANUAL).
CIRDER			DESCRIBES THE INDIVIDUAL ITEMS PERTAINING TO AN OPENINC (MUST FOLLOW CONTR OR PIER, IF PIER IS NOT USED IT MUST FOLLOW BPR.
	ELEV FULL	11-20	ELEVATION WHERE ORIFICE FLOW BECINS. BASED ON THE INDIVIDUALS BEST JUDCEMENT IT IS USUALLY SLICHTLY ABOVE THE POINT WHERE THE CIRDERS ARE ALL SUBMERED.
	ELEV CRDR BOT	21-30	THE ELEVATION WHERE THE GIRDERS FIRST BEGIN TO REDUCE FLOW AREA FROM THE CHANNEL.
	SKEW ANCLE	31-40	THE ANCLE OF THE FLOW IN DECREES WITH THE PERPENDICULAR TO THE CENTER LINE OF THE ROADWAY.
	ORIF COEF	41-50	THE COEFFICIENT TO BE USED IN THE ORIFICE FLOW FORMULA WHEN ORIFICE FLOW CONTROLS.
	WEIR COEF	51-60	THE WEIR COEFFICIENT FOR FLOW OVER THE BRIDGE DECK. THIS IS COMPUTED SEPARATE FROM THE FLOW OVER THE ROADWAY PROPER.
	DATA CARDS 1-5	11-70 BY 10 COL. FIELDS	THE X AND Y COORDINATES ARE NEEDED TO DESCRIBE THE SHAPE OF THE BRIDCE CRIDER THESE POINT ARE USED TO DEDUCT NET FLOW AREA FROM THE SECTION WHEN FLOW ENCOUNTERS THE GIRDER. THE FIRST AND LAST CIRDER POINTS DEFINE THE WEIR WHEN FLOW OVERTOPS THE CIRDER. THESE ARE ENTERED X1, Y1, X2, Y2, ETC. THE FIRST AND LAST POINTS MUST COINCIDE WITH POINTS ON THE CROSS SECTION (ROAD). USE ONLY THE NUMBER OF CARDS ACTUALLY NEEDED.
ENDTABLE			INDICATES THE END OF A GIRDER TABLE.
CULV1			ENTERS DATA TO BE USED IN COMPUTING LOSSES THROUCH CULVERTS.
	ROAD NAME	11-20	THE NAME OF THE ROAD THAT THIS CULVERT IS IN. (SEE NOTE 1, SCS-ENC-19).
	NO OF PIPES	21-30	THE NUMBER OF IDENTICAL OPENINCS - NO LIMIT ON THIS NUMBER.
	CULV CODE	31-40	SELECT THE APPROPRIATE CODE FROM TABLE 1.
CULV2			THIS IS A CONTINUATION OF CULV1 AND 'MUST' FOLLOW IT.
	DIA OR HEICHT	11-20	THE DIAMETER OF A CIRCULAR CULVERT IN FEET OR THE HEICHT IN FEET OF A BOX CULVERT OR PIPE ARCH.
	WIDTH	21-30	THE WIDTH IN FEET OF A BOX CULVERT OR PIPE ARCH.
	LENCTH	31-40	THE TOTAL LENCTH IN FEET OF THE CULVERT.
	ELEV US INVERT	41-50	THE ELEVATION OF THE UPSTREAM INVERT OF THE CULVERT.
	ELEV DS INVERT	51-60	THE ELEVATION OF THE DOWNSTREAM INVERT OF THE CULVERT.
	CULV 'n'	61-70	THE CULVERT 'n' VALUE, IF A VALUE CTHER THAN THAT ASSICNED BY TABLE 1 IS DESIRED.

TABLE 1 CULVERT CODE TABLE

CORRUCATED METAL PIPE							CONCRETE PIPE OR BOX			
CIRCULAR					PIPE-ARCH		CIRCULAR		SQUARE EDCE R.C. BOX	
INLET TYPE	RIVETED 'n'=.021	RIVETED 25% PAVED 'n'=.021	STRUC. PLATE 'n'=.032	STRUC. PLATE 25% PAVED 'n'=.026	PAVED 25% 'n'=.026	UNPAVED 'n'=.032	INLET TYPE	CODE 'n'=.012	INLET TYPE	CODE 'n'=.012
PROJECTION	12311	12411	12111	12211	32211	32111	SOCKET-END		30 TO 75 DEGREE	
MITERED	13322	13422	13122	13222	33222	33122	PROJECTION	22551	WINGWALL FLAIR	41111
HEADWALL	12333	12433	12133	12233	32233	32133	HEADWALL	22552	90 TO 15 DEGREE	
END SECTION	12335	12435					SQUARE EDCE		WINCWALL FLAIR	41122
BEVEL (A)	12346	12446	12146	12246			PROJECTION	22533	PARALLEL WINGWALLS	41133
BEVEL (B)	12347	12447	12147	12247			HEADWALL	22534		
TAPERED	11348	11448					END SECTION	22535		
							BEVEL (A)	22546		
							BEVEL (B)	22547		
							TAPERED	21548		

SCS-ENG-18
REV. MAR. 1976

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

WATER SURFACE PROFILE INPUT DATA

_____ BY _____ CHECKED _____ DATE _____
(JOB OR PROJECT)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

Control Word	Data Fields						Card Ident.
	1	2	3	4	5	6	
	REACH NAME	DRAINAGE AREA	CHANNEL LENGTH	FLOOD LENGTH	DAMAGE LENGTH	CHANNEL LENGTH	
REACH							
	XSEC NAME	DISPLACEMENT	VELOCITY				
REACH 2							
	XSEC NAME	SEGMENT No.	SEGMENT TYPE	LAST STATION	LAST ELEV		
SEGMENT							
	'n'	'r'	'n'	'r'	'n'	'r'	
NVALUE							
SEGMENT							
NVALUE							
SEGMENT							
NVALUE							
SEGMENT							
NVALUE							
SEGMENT							
NVALUE							
SEGMENT							
NVALUE							
	ROAD NAME	COEF OF CONTR					
CONTR							
	ELEV FULL	ELEV GRDR BOT	SKEW ANGLE	ORIF COEF	WEIR COEF		
GIRDER							
	STATION	ELEV.	STATION	ELEV.	STATION	ELEV.	
ENDTABLE							

NOTE: 2N VALUE CARDS CAN BE USED PER SEGMENT –4 SETS OF 'n'–'r' VALUES IS THE MAXIMUM

PAGE _____ OF _____

REACH		DEFINES THE ELEMENTS OF A REACH. THE ROAD AND REACH CARDS MUST BE IN THE ORDER OF COMPUTATIONS SINCE ONLY THE FIRST AND LAST SECTION NAMES ARE SHOW ON THE COMPUTE CARD.
REACH NAME	11-20	THE NAME OF THE REACH, EACH MUST BE UNIQUE. (SEE NOTE 1 SCS-ENG-19) THIS MUST BE THE SAME NAME AS THE CROSS SECTION TO BE USED, UNLESS FOLLOWED BY A REACH2 CARD.
DRAINAGE AREA	21-30	THE DRAINAGE AREA (SQ MILES) AT THE CROSS SECTION (REACH HEAD).
CHANNEL LENGTH	31-40	THE HYDRAULIC LENGTH OF THE MAIN CHANNEL SEGMENT (TO NEXT DOWNSTREAM SECTION).
FLOOD LENGTH	41-50	THE HYDRAULIC LENGTH OF THE MAIN FLOODPLAIN (TO NEXT DOWNSTREAM SECTION).
DAMAGE LENGTH	51-60	THE LENGTH TO BE USED IN COMPUTING TOTAL ACRES FLOODED IN THE REACH.
CHANNEL LENGTH	61-70	THE LENGTH OF CHANNEL IN THE DAMAGE REACH. (SEE TECHNICAL PROCEDURES FOR METHOD OF USE.)
REACH2		USE THIS CARD ONLY IF THE FOLLOWING DATA IS NEEDED. THIS CARD MUST FOLLOW A REACH CARD.
XSEC NAME	11-20	THE NAME OF THE CROSS SECTION TO BE TRANSPOSED FOR THE PRECEDING REACH. THIS SECTION MUST BE IN THE CURRENT DATA. IT MAY NOT BE USED IF A LINK CARD HAS BEEN READ SINCE THE XSEC WAS ENTERED.
DISPLACEMENT	21-30	THE ELEVATION CHANGE TO BE APPLIED TO EACH SURVEYED POINT ON THE CROSS SECTION. USE NEGATIVE VALUE IF SECTION IS TO BE LOWERED, POSITIVE IF IT IS TO BE RAISED.
VELOCITY	31-40	THE VELOCITY AT WHICH SCOUR DAMAGE FIRST OCCURS. THIS IS USED TO COMPUTE ACRES OF SCOUR. (NOT OPERATIONAL AT PRESENT)
SEGMENT		DESCRIBES ELEMENTS OF A SEGMENT OF A CROSS SECTION. EACH SEGMENT CARD MUST BE FOLLOWED BY ITS ASSOCIATED 'NVALUE' CARDS. UP TO 6 SEGMENT CARDS MAY BE ENTERED FOR EACH CROSS SECTION.
XSEC NAME	11-20	THE NAME OF THE CROSS SECTION THAT THIS SEGMENT IS A PORTION OF.
SEGMENT NO	21-30	ANY NUMBER BETWEEN 1 AND 6, A TOTAL OF 6 SEGMENTS MAY BE USED. THEY MUST BE NUMBERED CONSECUTIVELY, BUT NOT NECESSARILY ENTERED CONSECUTIVELY. I.E. IF 4 SEGMENTS ARE USED THEY MAY BE ENTERED 4,2,3,1 BUT NOT BE NUMBERED 4,2,5,1.
SEGMENT TYPE	31-40	THREE SEGMENT TYPE CODES MAY BE USED: C FOR A CHANNEL SEGMENT. THE WIDTH IS USED TO DETERMINE CHANNEL ACRES FLOODED. CHANNEL KD VALUES ARE USED AS COMPUTED. D FOR A DAMAGE SEGMENT. ITS AREA IS INCLUDED IN ACRES FLOODED AND KD VALUES ARE MODIFIED BY THE SQUARE ROOT OF THE MEANDER FACTOR. (SEE TECHNICAL PROCEDURE). N FOR A NON DAMAGE SEGMENT. IT IS NOT TO BE INCLUDED IN DAMAGE ACRES FLOODED BUT THE LENGTH USED IS THE DAMAGE LENGTH. ITS KD VALUES ARE MODIFIED THE SAME AS THE 'D' SEGMENT.
LAST STATION	41-50	THE STATION ON THE CROSS SECTION WHICH MARKS THE END OF THE SEGMENT. THIS MUST BE A SURVEYED POINT. THIS ALSO INDIRECTLY MARKS THE BEGINNING OF THE SEGMENT NUMBER THAT IS 1 HIGHER THAN THIS NUMBER.
LAST ELEVATION	51-60	THE ELEVATION ASSOCIATED WITH THE 'LAST STATION' (OPTIONAL). IF THERE IS ONLY ONE STATION WITH THE 'LAST STATION' VALUE, THE ELEVATION VALUE IS NOT NECESSARY. HOWEVER IF THE SEGMENT ENDS ON A VERTICAL BANK THIS VALUE WILL INDICATE WHETHER THE SEGMENT ENDS AT THE TOP OR BOTTOM OF THE BANK.
NVALUE		ENTERS THE 'n' VALUES AND ASSOCIATED HYDRAULIC RADII. **NOTE THIS CARD MUST ALWAYS FOLLOW THE SEGMENT CARD OR ANOTHER 'n' VALUE CARD.
"n"	11-20,31-40,51-60	THE 'n' VALUES TO BE USED. UP TO 4 'n' VALUES MAY BE USED.
"r"	21-30,41-50,61-70	THE HYDRAULIC RADIUS ('r') ASSOCIATED WITH THE ABOVE 'n' VALUES.
		IF ONLY 1 'n' VALUE IS ENTERED IT IT USED FOR ALL FLOW DEPTHS, IF 2 'n' VALUES AND 1 'r' IS ENTERED ALL FLOWS WITH 'r' LOWER THAN THE 'r' GIVEN USE THE FIRST 'n' VALUE. ALL FLOWS WITH AN 'r' GREATER USE THE 2ND 'n' VALUE. IF 2 OR MORE 'r'S ARE GIVEN THE 'n' VALUE IS INTERPRETED ON A STRAIGHT LINE BASIS FOR ALL VALUES OF 'r' WHICH LIE BETWEEN THE GIVEN ONES. IF THE ACTUAL 'r' IS LESS THAN THE FIRST 'r' GIVEN THE FIRST 'n' VALUE IS USED, IF IT IS GREATER THAN THE LAST 'r' GIVEN THEN THE LAST 'n' VALUE IS USED.
CONTR		GIVES THE NEEDED DATA IF THE BRIDGE IS TO BE COMPUTED BY THE CONTRACTED OPENING METHOD.
COEF OF CONTR	21-30	THE CONTRACTION COEFFICIENT TO USE IN THE CONTRACTION FORMULA.
GIRDER		DESCRIBES THE INDIVIDUAL ITEMS PERTAINING TO AN OPENING (MUST FOLLOW CONTR OR PIER, IF PIER IS NOT USED IT MUST FOLLOW BPR).
ELEV FULL	11-20	THE ELEVATION WHERE ORIFICE FLOW BEGINS. THIS MUST BE BASED ON THE INDIVIDUALS BEST JUDGEMENT BUT USUALLY IS SLIGHTLY ABOVE THE POINT WHERE THE GIRDERS ARE ALL SUBMERGED.
ELEV GRDR BOT	21-30	THE ELEVATION WHERE THE GIRDERS FIRST BEGIN TO REDUCE FLOW AREA FROM THE CHANNEL.
SKEW ANGLE	31-40	THE ANGLE OF THE FLOW IN DEGREES WITH THE PERPENDICULAR TO THE CENTER LINE OF THE ROADWAY.
ORIF COEF	41-50	THE COEFFICIENT TO BE USED IN THE ORIFICE FLOW FORMULA WHEN ORIFICE FLOW CONTROLS.
WEIR COEF	51-60	THE WEIR COEFFICIENT FOR FLOW OVER THE BRIDGE DECK. THIS IS COMPUTED SEPARATE FROM THE FLOW OVER THE ROADWAY PROPER.
DATA CARDS 1-5	11-70 BY 10 COL.	THE X AND Y COORDINATES ARE NEEDED TO DESCRIBE THE SHAPE OF THE BRIDGE GIRDER. THESE POINTS ARE USED TO DEDUCT NET FLOW AREA FROM THE SECTION WHEN FLOW ENCOUNTERS THE GIRDER. THE FIRST AND LAST GIRDER POINTS DEFINE THE WEIR WHEN FLOW OVERTOPS THE GIRDERS. THESE ARE ENTERED X1, Y1, X2, Y2, ETC. THE FIRST AND LAST POINTS MUST COINCIDE WITH POINTS ON THE ROAD CROSS SECTION USE ONLY THE NUMBER OF CARDS ACTUALLY NEEDED.
ENDTABLE		INDICATES THE END OF A GIRDER TABLE.

SCS-ENG-19
REV. DEC. 1974

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

CROSS SECTION DATA

_____ BY _____ CHECKED _____ DATE _____
(JOB OR PROJECT)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

Control Word	Data Fields						Card Ident.
	1	2	3	4	5	6	
	XSEC NAME	HI					
SECTION							
	STATION	ELEV.	STATION	ELEV.	STATION	ELEV.	
ENDTABLE							
NOTE:	IF ROD READINGS ARE GIVEN TURN CARDS MAY BE NEEDED						

PAGE _____ OF _____

SECTION			ENTERS THE DATA FOR A CROSS SECTION OR ROAD.
	NAME	11-20	THE NAME OF THE SECTION OR ROAD (SEE NOTE 1).
	HI	21-30	THE HI IF ROD READINGS ARE GIVEN. CROSS SECTION DATA MAY BE ENTERED IN ANY ORDER AS IT IS SORTED BY THE X DISTANCE AFTER ENTRY. IF 2 POINTS HAVE THE SAME X DISTANCE THEY MUST BY ENTERED IN THE PROPER ORDER AS THESE POINTS WILL NOT BE REVERSED.
	DATA CARDS 1-16	11-70 (BY 10 COL. FIELDS)	THE X AND Y COORDINATES OF THE CROSS SECTION. THESE ARE ENTERED X1, Y1, X2, Y2, ETC. USE ONLY THE NO OF CARDS ACTUALLY NEEDED. ROAD SECTIONS ARE DESCRIBED THE SAME AS VALLEY SECTIONS. WITH BPR AND CONTR BRIDGES THE POINTS WOULD BE ENTERED AS THE SECTION WOULD LOOK WITH THE BRIDGE DECK, AS DEFINED BY THE GRIDER CARDS, REMOVED. WITH CULVERTS THE POINTS ARE ENTERED AS THE ROAD BED ABOVE THE CULVERT.
ENDTABLE			INDICATES THE END OF A SECTION TABLE.

NOTE 1 NAMES MAY CONSIST OF FROM 1 TO 6 ALPHA NUMERIC CHARACTERS. IMBEDDED BLANKS ARE IGNORED SO A HYPHEN (-) SHOULD BE USED TO SEPARATE CHARACTERS IF DESIRED. THE NAME MAY BE ANYWHERE WITHIN THE NAME FIELD.

NOTE 2 IF ROD READINGS ARE USED THE FOLLOWING CARD IS NEEDED:

TURN			INDICATES A TURNING POINT IN THE SURVEY
	BS	11-20	THE BACKSIGHT ON THE TURNING POINT
	FS	21-30	THE FORESIGHT ON THE TURNING POINT

SCS-ENG-20
JAN. 1973

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

WATER SURFACE PROFILE INPUT DATA

_____ BY _____ CHECKED _____ DATE _____
(JOB OR PROJECT)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

Control Word	Data Fields						Card Ident.
	1	2	3	4	5	6	
	FROM XSEC	TO XSEC	STARTING XSEC				
COMPUTE							
TITLE							
COMPUTE							
TITLE							
COMPUTE							
COMPUTE							
LINK							
	FILE NAME	FROM (XSEC)	TO (XSEC)				
CHANGE							
END							
ENDJOB							
ENDRUN							

PAGE ____ OF ____

COMPUTE		THIS SIGNALS COMPUTATIONS TO START.
FROM	11-20	THE FIRST CROSS SECTION NAME IN THE SERIES OF NAMES TO BE USED IN COMPUTATIONS.
TO	21-30	THE LAST CROSS SECTION NAME IN THE SERIES OF NAMES TO BE USED. INTERMEDIATE NAMES WILL BE SELECTED AS THEY APPEAR IN THE REACH FILE.
STARTING XSEC	31-40	THE NAME OF THE CROSS SECTION WHERE STARTING ELEVATIONS ARE TO BE TAKEN. THIS MAY BE THE SAME NAME AS THE FROM FIELD, OR THE CURRENT NAME IN THE STARTS OR STARTE FILE OR A NAME IN THE TRIB FILE. IN THE CASE THAT THIS NAME OCCURS IN BOTH THE START FILE AND TRIB FILE THE START FILE IS USED. IF THE NAME OCCURS IN NEITHER THE START FILE OR TRIB FILE THEN COMPUTATIONS BEGIN AT CRITICAL DEPTH. IF THIS IS LEFT BLANK THE SAME NAME AS IN THE FROM FIELD IS USED.
LINK		IF THE NO. OF SECTIONS IN A WATERSHED IS LARGER THAN THE PROGRAM LIMIT THIS WILL ALLOW THE WATERSHED TO BE DIVIDED INTO SUBAREAS WITH EACH SUBAREA HAVING LESS SECTIONS THAN THE PROGRAM LIMIT. THE SINGLE JUNCTION POINT BETWEEN SUBAREAS IS ALWAYS A CROSS SECTION. THIS JUNCTION SECTION MUST BE LISTED ON THE TRIB CARD. THE COMPUTE CARD WHICH FOLLOWS WOULD NORMALLY BE COMPUTE NAME1 (FIRST REACH IN THE NEW SUBAREA), NAME2, NAME3 (TRIB CARD). SINCE THE LINK CARDS MAKE ALL CROSS SECTION DATA READ BEFORE THAT POINT UNAVAILABLE, SUCH THINGS AS A REACH2 DISPLACEMENT WITH A SECTION DNSTM FROM THE LINK TO UPSTM FROM THE LINK IS IMPOSSIBLE.
CHANGE		USED WHEN UPDATING DATA FILES (SEE SPECIAL SECTION ON UPDATING)
FILE NAME	11-20	THE NAME OF THE FILE TO BE CHANGED. FILES THAT MAY BE CHANGED ARE: REACH (INCLUDES ROAD), SECTION, DISCHARGE, SEGMENT, TRIB, CONTR. BPR, CULV1.
	NOTE:	THE FOLLOWING FROM AND TO FIELDS ARE USED FOR THE 'REACH' FILE ONLY.
FROM (XSEC)	21-30	THE FIRST REACH TO BE CHANGED.
TO (XSEC)	31-40	THE LAST REACH NAME TO BE CHANGED. ALL REACH DATA BETWEEN AND INCLUDING THE FROM AND TO NAMED WILL BE DELETED. IF NEW DATA ARE DESIRED THEY MUST BE ENTERED DIRECTLY AFTER THE CHANGE CARD IN THE ORDER THAT COMPUTATIONS WILL TAKE PLACE. IF THE 'TO' FIELD IS LEFT BLANK THEN ANY NEW REACH (OR ROAD) CARDS THAT FOLLOW WILL BE INSERTED IMMEDIATELY AFTER THE NAME IN THE FROM FIELD. THE DATA ASSOCIATED WITH THE 'FROM' NAME ARE NOT ALTERED. IF DATA FOR ONLY ONE REACH NEEDS TO BE CHANGED THAT NAME WILL APPEAR IN BOTH THE 'FROM' AND 'TO' FIELDS.
END		TO BE USED WHEN THE UPDATES ARE COMPLETED.
ENDJOB		TO BE USED BETWEEN TWO WSP2 JOBS.
ENDRUN		TO BE USED AFTER THE LAST JOB IN THE RUN (CALLS EXIT).